SCIENTIFIC AMERICAN

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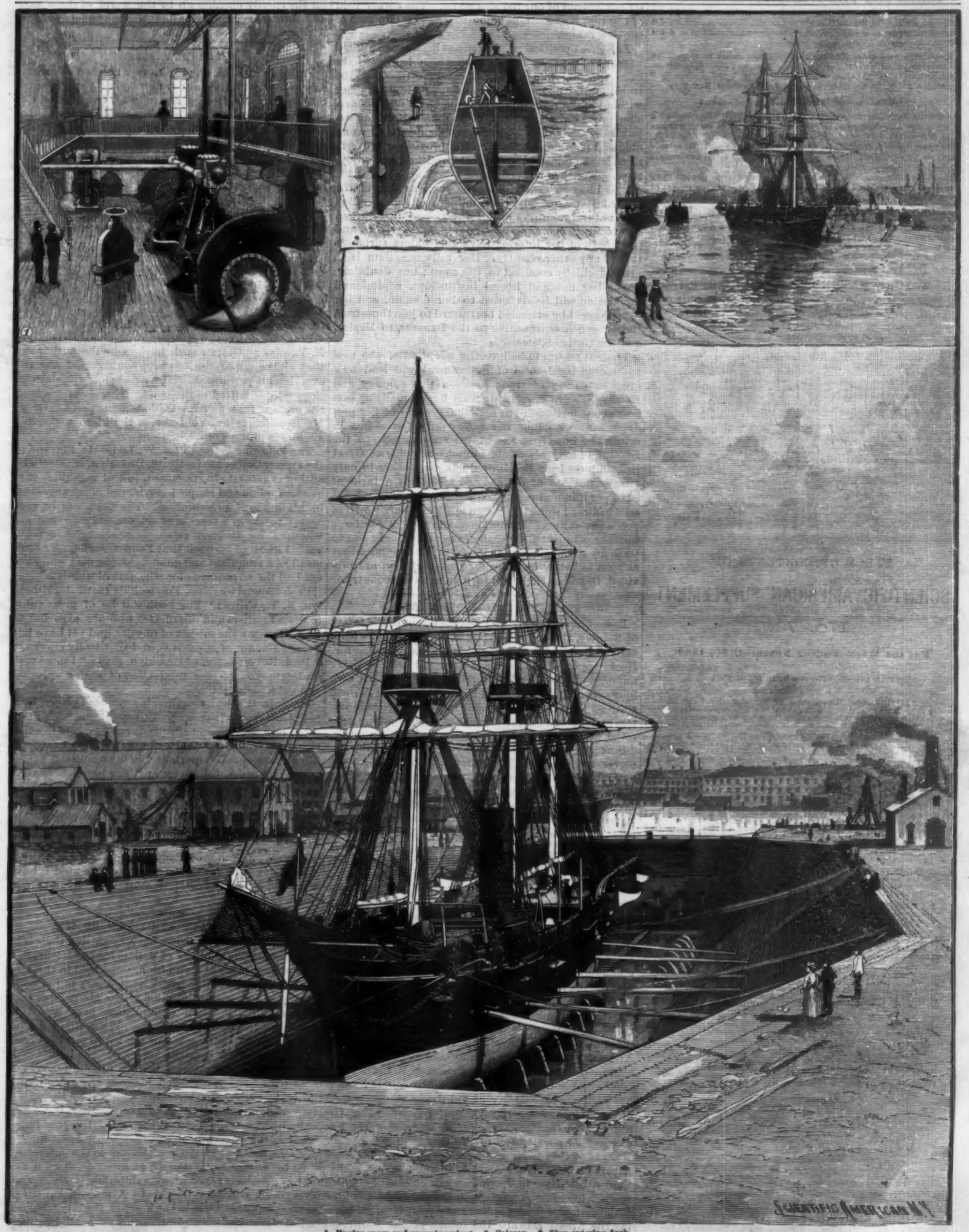

1. Engine room and pumping plant. 2. Caisson. 3. Ship entering dock.

THE NEW SIMPSON TIMBER DRY DOCK AT THE BROOKLYN, N. Y., NAVY YARD.—[See page 341.]

Scientific American.

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NEW YORK, SATURDAY, NOVEMBER 30, 1889.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 726.

For the Week Ending November 30, 1889.

Price 10 cents. For sale by all newsdealers

THE UNITED STATES OF BRAZIL.

The 14th day of November, 1889, is likely to be a memorable day in the history of Brazil, for it was then the monarchy was overthrown and the great country assumed the republican form of government. The good Emperor Dom Pedro and the royal family were expelled from the country and left for Europe, the republic and free suffrage were proclaimed, the eighteen provinces are to be made States with local governments and all political institutions are to be closely patterned after those of this country. The new national flag in its general style resembles that of the United States, except that Brazil has adopted yellow and white stripes instead of our red and white. The corner field of the new flag contains eighteen stars, one for each of the new States.

This great political revolution has been accomplished without bloodshed. The causes which led to it have been working like a yeast for a long time, and the transition, although sudden and complete, took place without any serious public or commercial disturbance. The provisional president of the new Brazilian republic is Dodoro da Fonseca. He is described as an able and reliable statesman. The provisional government has so far acted with great prudence, and enjoys the confidence of the people.

Brazil has an area almost the same as that of the United States, namely, three millions of square miles. Her natural resources are of the richest description. Her territory is intersected by innumerable rivers, and the length of her interior navigable waters surpasses that of any other country. Her railway system is at present chiefly confined to the coast; but doubtless, under her new and liberal institutions, capital and population will be attracted to her domain, and her railways will be extended northward to join those from the other States, reaching to the Isthmus, to Mexico, and the United States.

There is reason to believe the adoption of the new and more liberal form of government will lead to a great extension of trade between this country and Brazil. We are purchasing from her annually at present about forty millions of dollars worth of her products, and we admit her coffee duty free. But in return she buys from the United States goods to the amount of only about six millions of dollars. Great Britain buys from Brazil products amounting to only twenty millions of dollars, and maintains a tariff of $3.50 per hundred pounds on Brazilian coffee, and yet sells to Brazil some thirty-two million dollars worth of goods per annum. It would seem in view of our large purchases in Brazil the balance of trade ought not to be so greatly against us as it now is. It is claimed that as soon as better facilities for transportation are provided, Brazilian trade will turn more to this country.

STANLEY'S LATEST DISCOVERIES.

Recent advices leave no room for doubt of the safety of Stanley, the African explorer, whose arrival within actual reach of the telegraph may be daily looked for. He is approaching the Zanzibar coast with a party numbering some twelve hundred, including his own followers and those of Emin Pasha, the central African state so long governed by the latter, with headquarters at Wadelai, having been overrun by and incorporated with the Soudanese possessions of the Mahdi.

Since the latter part of the year 1887, when the explorer left Stanley Falls, on the Upper Congo, the news from him has been very meager, and that which did come was anything but hopeful, especially when taken in connection with the reports that Emin's settlement had been broken up and Emin himself was a prisoner in the hands of the Mahdi. The country in which Stanley's route lay is a tableland of some five thousand feet elevation, directly under the equator, with many mountain ridges and snow-capped peaks, much of the surface heavily wooded, and having a vegetation so prolific as to be almost impenetrable, while it has a very considerable population, mostly of small savage tribes, always engaged in war and slave stealing. In a region of this character, about one thousand miles each way in extent, Stanley has been marching and countermarching for nearly two years, first in the interests of commerce and for purposes of exploration, and finally as the successful rescuer and deliverer of Emin Pashi from the Mahdi.

The additions made by the explorer to our knowledge of the geography of this vast region in Central Africa are necessarily limited by the meagerness of the accounts so far received, but it is seen that they will be of great importance. Heretofore the Albert Nyanza has been considered the source of the southwest branch of the White Nile, the Victoria Nyanza being the source of its southeast branch. Stanley, however, has discovered an extension of the Southern Nyanza, or Nyanza of Usongora, which, he says, "is called now Albert Edward Nyanza, and is about 900 feet higher than Albert Nyanza, having an exit at Semliki, which receives over fifty streams from the snowy range of the Rujeuzori, and finally enters the Albert Nyanza, making the Albert Edward the source of the southwest branch of the White Nile." The area of the extension is said to be 26,000 square miles.

It will probably be a wonderful and thrilling story which the adventurers will have to tell when they finally reach home, and it will also be a story of hardships and privations endured, of sickness, want of food, and unremitting toil of the severest kind under the blaze of a tropical sun or in the more deadly African morasses and jungles, but the results are certain to place the name of Henry M. Stanley in a yet higher place than it has heretofore occupied among the world's great explorers. He has succeeded in rescuing the party of Emin Pasha, and his other work cannot fail to give an important impetus and a more intelligent understanding to the numerous enterprises now on foot for the speedy opening up to the world of these vast and hitherto almost unknown regions of Central Africa.

OUR NEW BOOK.

Probably no book on physics ever reached so great a sale in so short a time as our new book "Experimental Science," by Mr. George M. Hopkins, treating on elementary practical and experimental physics. Its value has been acknowledged by a large number of our most eminent scientists.

Prof. E. S. Dana, of Yale University, New Haven, Conn., writes: "I shall expect myself to obtain from it many suggestions which will aid in my instructions."

Prof. John Trowbridge, Jefferson Physical Laboratory, Cambridge, says: "It will do much to popularize the great subject of physical science."

Prof. S. P. Langley, Smithsonian Institution, Washington, D. C., writes: "Many of the experiments and illustrations are new to me."

Prof. D. W. Hering, University of the City of New York, says: "I know of no work that is at the same time so popular in style and so scientific in character."

Prof. W. C. Peckham, Adelphi Academy, Brooklyn, N. Y., says: "Of few such books can the author say that all the apparatus has been constructed and the experiments performed by himself before the descriptions were admitted to the book. This claim, made in the preface, from so conscientious an experimenter as Mr. Hopkins is known to be, is the highest possible guarantee of the work."

The following is from Prof. W. Le Conte Stevens, of the Packer Collegiate Institute, Brooklyn, N. Y.: "The author is accurate in statement, full of ingenious suggestions, plain and simple in style, and admirably clear in his mode of presentation. The book will be very useful to me as a teacher of science, and my students will use it for frequent reference as a laboratory manual. I know of no book that I can so confidently commend as a stimulant and guide to young men who have not had the advantage of mathematical training."

Prof. Samuel Sheldon, Polytechnic Institute, Brooklyn, N. Y., writes: "The book will be of great value to those teachers and instructors who are expected to fully illustrate the subject of physics, and yet have but a small amount of apparatus, and that badly chosen."

Prof. Robert Spice, of Brooklyn, says: "I must congratulate you on the production of such a splendid and valuable work."

Prof. R. H. Thurston, director Sibley College, Cornell University, Ithaca, N. Y., says of the book: "It is full of ingenious and effective arrangements in experimentation and crowded with interesting matter. It fills a space of real importance, in my opinion."

Mr. Thomas A. Edison says: "The practical character of the physical apparatus, the clearness of the descriptive matter, and its entire freedom from mathematics give the work a value in my mind superior to any other work on elementary physics of which I am aware."

Prof. W. J. Rolfe, of Cambridgeport, Mass., writes: "The book is by far the best thing of the kind I have seen, and I can commend it most cordially and emphatically."

THE AMERICAN EXHIBITION OF 1892.

The citizens of New York have completed their subscription of five millions of dollars for the celebration by an International Exhibition, to be held in this city in 1892, of the four hundredth anniversary of the landing of Columbus. In addition to the above large sum two hundred thousand dollars have been raised to meet the preliminary expenses. With this splendid fund in hand, nothing is now needed to put the necessary works under construction except the influence of the national government, mainly for the purpose of securing official recognition abroad. New York will go to Congress, not to solicit money from the public treasury for exhibition buildings, for that is already subscribed, but simply to ask such legislative encouragement as the government can reasonably grant toward giving a national stamp or character to the enterprise.

So far as money for buildings, grounds, and all the paraphernalia of the great exhibition is concerned, everything needful is provided. A magnificent site of several hundred acres in the heart of the city has been selected, convenient and accessible from all directions by land and water. All those splendid highlands extending from the northerly end of Central Park west-

erly to the Hudson River, embracing the Morningside Park, the Riverside Park, and the intervening grounds as far north and south as may be required, have been selected. Nothing could surpass the beauty and excellence of the chosen location. There is every promise of the assembly here in 1892 of a more wonderful display of industry, science, and art than has ever been realized in the history of the world.

BREWING CHEMISTRY.

Those who know anything about the condition of the manufacturing industries abroad are aware of the state of development they have reached and how scientific investigators are constantly called on to procure the best possible results for the minimum expenditure of time, labor, and money. Experimentation is in the hands of scientists, no brewery for example being complete without its expert chemist. In this industry, as a result, there are scientific brewers' magazines of a very high order, contributions on practical brewing find a place in the leading chemical *Zeitschriften*, a literature on the subject is found in works on applied chemistry, a number of valuable text books have been printed, the chemistry of brewing is taught in the technical schools, etc. There are scattered through this country a few experts who do work, occasionally, for the various breweries, but who hitherto have not played the important role one might expect when he considers the enormous sums of money invested in these enterprises. The operations of the English breweries syndicate revealed but a small part of the capital stock.

The all-important personage in these establishments is the *braumeister*, a very practical person in his specialty, but usually one who is densely ignorant otherwise, and as obstinate as he is ignorant. Suggestions from scientific experts are received by him in the worst possible humor, for he regards the brewer's chemist as a wanton persecutor. Any hitch in the normal workings of the brew he ascribes at once to poor material, and cannot appreciate that his treatment may be faulty. He needs the chemist and the latter needs him in lager beer making in America.

This last is quite different from that pursued in England and Germany, where the government considers any ingredient in the manufacture of beer other than pure malt, hops, yeast, and water an adulterant, whose use is prohibited and is finable. In this country, on the contrary, it is the general rule, and not the exception, to substitute for at least part of the malted barley a variety of cereals, such as corn, prepared in several ways, wheat, oats, and rice, also sugar and glucose. The hops sometimes find their place taken by "hop aroma" and "hop auxiliary," while caramel, "beer color," and other chemically prepared substances (all more or less dangerous to the health) give color to the beer; alum, fish sounds, isinglass, shavings, etc., are used to clarify it, and a variety of preservative solutions, antacid tablets, sulphites of lime, soda, or potash, bicarbonate of soda, or salicylic acid—all of which are objectionable from a sanitary standpoint—are used to preserve the beer, destroy the acid, and make it ready for export. Ostensibly the reason for these adulterations is to make more money for the brewer. The chemical expert will tell you, however, that barley grown in artificially fertilized ground has other properties than those usually ascribed to the pure article by brewers and chemists, and that these deficiencies in the American product must be compensated by introducing new conditions. This departure from the beaten track of brewing, pure and simple, is what makes the brewer's chemist not only useful, but more or less of a necessity.

Take a sample of beer to a good analyst, and he can tell you its deleterious impurities, such as salicylic acid, sulphites, etc.; he can ascertain for you the exact quantity of water and extractive solids, alcohol and sugars, nutritive and non-nutritious substances, etc. The brewer's chemist, besides this, must do synthetic work, he must solve such a problem as the following: Given a sample of beer with a certain definite taste, color, and other physical properties, which a brewer, for reasons of his own, desires to imitate, to find a complete brewer's formula.

This will include the proportions of the several ingredients to be used and all the details of the subsequent operations of grinding and washing the malt, extracting the wort, boiling it with hops, the fermentation at a given temperature with a certain kind of yeast, clarifying, preserving, racking, etc. A bacteriologist can easily recognize the yeast plant under the microscope, but the brewer's chemist must instantly point out the various kinds of vegetable ferments in a sample of yeast, know the action of each, and be able to state whether or not this or that predominant species of *saccharomyces* is to give his beer the desired color, taste, and facility of separation of the yeast, and to act accordingly. A chemist can determine the quantity of soluble protein in the malt, and thence the approximate amount of the chemical diastase present which is to change starch to grape sugar, ready for conversion thence by the yeast plant into alcohol and carbonic acid. The specialist must also, besides this, know how to recommend substitutes for the malt, and present simultaneously a complete brewer's formula; if there be something wrong with the brew, he must provide a remedy at once, else his enemy the *braumeister* will call him a worthless being; he must be up to all the tricks of the trade in changing the color and taste, and in preparing the beer for export by means of chemicals.

Thus it will be seen that the brewer's chemist must be a practical *braumeister* and have in miniature a complete brewer's outfit. He must be a good analyst and microscopist, though devoted to a specialty in both fields. For all this he is not to be underpaid, for successful brewers are known to accumulate fortunes rapidly, and therefore can afford to be liberal. In point of fact, such chemists are well paid, even in Germany and England, the chief chemist of one large establishment in Great Britain receiving £10,000 per year. Brewers are having their sons educated in the one large brewer's laboratory in New York City, and it is said there is soon to be a great demand for chemists expert in this field. Some are being brought over surreptitiously from abroad; but there is a disposition to employ native talent if it can be procured. This, then, is a promising field for the investment of time and money by the college graduate, and it would be well even for the technical schools to give it a place in their curriculum. There is money in it, and a prospect of employment for the many.

POSITION OF THE PLANETS FOR DECEMBER.

SATURN

is morning star, and his movements during the month form an interesting study. He rises about 11 o'clock on the first of the month and about 9 o'clock at the close of the month. He has been moving eastward, or in direct motion, but is stationary on the 15th, and then moves westward, or in retrograde motion. He will, therefore, approach Regulus, the bright star on the west of him, and will meet and pass the star on March 29th of the coming year. The planet may be readily found, rising about 10 o'clock on the middle of the month, and being at that time about 5° east of Regulus. Saturn rises on the 1st at 10 h. 55 m. P. M. On the 31st he rises at 8 h. 56 m. P. M. His diameter on the 1st is 17".2, and he is in the constellation Leo.

MERCURY

is morning star until the 7th, and then evening star. He is in superior conjunction with the sun on the 7th, at 7 h. P. M., and after that event commences his eastward journey from the sun. He meets Jupiter on his way, who is journeying westward toward the sun. The two planets are in conjunction on the 26th, at 8 h. 35 m. P. M. Mercury rises on the 1st at 6 h. 56 m. A. M. On the 31st he sets at 5 h. 31 m. P. M. The diameter of Mercury on the 1st is 4".6, and he is in the constellation Scorpio.

JUPITER

is evening star. He is very near the sun, setting about a half hour later than the sun at the close of the month. Jupiter sets on the 1st at 6 h. 34 m. P. M. On the 31st he sets at 5 h. 8 m. P. M. His diameter on the 1st is 31".4, and he is in the constellation Sagittarius.

VENUS

is morning star. She, like her rival Jupiter, is near the sun, though on his western, while Jupiter is on his eastern side. Bright-eyed observers may still behold the fairest of the stars in the first half of the month, for she rises more than an hour before the sun, and is low down in the southeast. Venus rises on the 1st at 5 h. 31 m. A. M. On the 31st she rises at 6 h. 38 m. A. M. Her diameter on the 1st is 10".8, and she is in the constellation Libra.

MARS

is morning star. He may be readily found from his vicinity to Spica during the month. He passes the bright star on the 15th. He is in conjunction with Uranus on the 24th. Mars rises on the 1st at 2 h. 13 m. A. M. On the 31st he rises at 1 h. 43 m. A. M. His diameter on the 1st is 5".2, and he is in the constellation Virgo.

URANUS

is morning star. He rises on the 1st at 3 h. 17 m. A. M. On the 31st he rises at 1 h. 24 m. A. M. His diameter on the 1st is 3".5, and he is in the constellation Virgo.

NEPTUNE

is evening star. He may be found between the Pleiades and Aldebaran, and is in fine position for telescopic observation. Neptune sets on the 1st at 6 h. 27 m. A. M. On the 31st he sets at 4 h. 25 m. A. M. His diameter on the 1st is 2".6, and he is in the constellation Taurus.

Saturn, Mars, Uranus, and Venus are morning stars at the close of the month. Jupiter, Mercury, and Neptune are evening stars.

SOME THOUGHTS ABOUT CHINA.

In an article in the SCIENTIFIC AMERICAN of Sept. 28, 1889, entitled "The Insulted Chinese," Rev. Chas. H. Fowler is quoted as prophesying trouble between the United States and China at no very distant day, on account of the latter's anti-Chinese laws. "I tell you they are thinking, and trouble is brewing," he is quoted as saying. And again: "They are making great guns and ironclads and manning them."

It is doubtless true that China is making great strides in the art of war; this, however, does not necessarily mean that she is getting ready to retaliate upon the United States for her anti-Chinese laws. But it does mean that China, by the adoption of modern engines of war, of the arms, tactics, and discipline of the West, is rapidly putting herself in position to resist the encroachments and command the respect of other nations. The prejudices of the nation against modern civilization are slowly but steadily breaking down; they may not see in the Christian religion a better one than their own, but they do see the advantages of modern appliances, and in no case have they more clearly illustrated the fact than by the adoption of modern weapons in their armies. The constant intercourse, becoming more intimate every year, between China and the countries of the West renders the introduction, to a greater or less extent, of the civilization of the latter a mere matter of time. That the result of this should be the complete supplanting of the Chinese civilization by that of the West is highly improbable, nay impossible. But the supplanting of the Chinese civilization in many things, and radical changes in many others, seem almost inevitable. The result will naturally be the formation of a new system, of a new civilization in fact, from the intermingling of the old and the new.

And now let us imagine China placed upon an equal footing with ourselves, reinvigorated by the infusion of new ideas and new principles, and, more than all, of the spirit of progress; with her great resources developed by a wise administration; with a large army, well disciplined and supplied with arms and equipments equal to those of the most advanced European nations; and, what would be most dangerous of all, a powerful and numerous navy. These, combined with her enormous population, would make her indeed a formidable foe. At present we have comparatively little to apprehend from a rupture with China, but in the future we may find in her a foeman worthy of our steel. The day may not be far distant when China will be ranked among the most powerful nations of the earth.

And now let us take a glance in the direction of Japan. Here we are astonished by the wonderful progress she has made since Perry's expedition, and especially during the last twenty years. Her power and prosperity are steadily increasing. The recent adoption by Japan of a constitutional form of government was a great advance in the path of progress, and marks a turning point in her history. Japan is destined to be one of the great states of the future.

The Anglo-Indian empire and Australia will not always remain subject to Great Britain. Both of them are likely to become powerful states in the future. It is probable in the next century the Pacific will wash the shores of some of the most powerful if not the dominant nations of the world.

Stephen Freeman.

The name of Stephen Freeman has long been familiar to the farmers and those engaged in the agricultural implement trade in the United States; most of these know him as an enterprising manufacturer and business man who, from infancy, being thrown upon his own resources, had, by his traits of honesty, industry, perseverance, aided by natural ability, gained an enviable position among men, being, in a word, a self-made man, and, as such, will be sorry to learn of his death, which occurred at his home in Racine, Tuesday, September 10, from an attack of pneumonia.

He had but just returned from a short trip to his native home, and seemed to be enjoying the best of health.

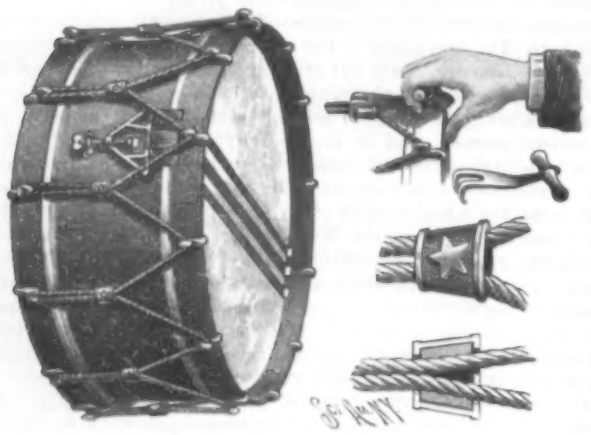
Mr. Freeman was born on the island of Anglaise, North Wales, 1834, and was left an orphan before a year old. With no opportunity for an education except that gained at a Sunday school and by home study, he was apprenticed in the boiler maker's trade at the age of ten. On the completion of his apprenticeship he moved to Liverpool, where he worked at his trade until 1856, with the exception of nine months spent in the Crimean war.

Mr. Freeman then came to the United States, settling at Rome, N. Y., from which place he went to Chicago in 1857, thence to St. Louis and Centralia, at all of which places he met with varying success. Soon after the opening of the rebellion he entered the United States navy, in the capacity of boiler maker, and remained until 1864, when, on account of poor health, he left the service, and after a short time spent in business at Cairo, moved to Wisconsin, settling first at Milwaukee, then at Watertown, and finally, in 1867, he came to Racine, where he founded the business which now bears his name, and which has grown, largely by his efforts, which have been efficiently aided by his sons, to be one of the best known in the country, the S. Freeman & Sons Manufacturing Company. Mr. Freeman was also president of the Wisconsin Agriculturist Company, publishers of this paper. —*Wisconsin Agriculturist.*

JOHNSTON'S PATENT SIDE DRUM.

The drum shown in the accompanying illustration may be used either for military or orchestral purposes. It is quick of vibration, is strong of tone, and possesses several novel features that have been patented by Mr. W. R. Johnston.

One of these is the brace, which is an oval-shaped metal shell provided internally (see cut) with an elastic



JOHNSTON'S PATENT SIDE DRUM.

lining which serves to prevent the brace from slipping on the cord. It stays where it is placed, and keeps an even pressure on the head. It is light and ornamental and will not slip, stretch, or break. When the head is to be stretched, a bifurcated hook is employed, which is inserted over the brace on each side of the cord. It is also provided with a handle which enables the brace to be drawn down without injury to the fingers. The triple snares which are used in this drum are clamped to the shell of the drum on one side and at the other side are retained by the triangular snare strainer, which is of peculiar construction. Holes are cut in the hoop so that when tension is applied to the snares after they are passed through these openings, they will be drawn close to the snare head, greatly increasing the vibration and tone of the instrument. The snare strainer is triangular in shape and is provided with an opening at its upper end, through which passes the screw tightener. This screw also passes through an apertured lip that is screwed to the side of the drum, so that by simply turning the thumb screw the snare will be tightened and held firmly stretched. This drum has proved so far satisfactory that it was adopted by the Massachusetts Volunteer Militia in June, 1889. The 17 in. by 10 in. drum is used for military purposes, drum corps, etc., and the 14 in. by 5½ in. for the orchestra.

For further information address the patentee, Mr. W. R. Johnston, Waltham, Mass.

AN OPTICAL ILLUSION.

We are going to present to our readers the solution of a problem that came in our way by accident during our peregrinations in search of curiosities of all kinds, and which consists in making a few persons appear like an innumerable crowd. This interesting scientific recreation was exhibited some time ago in a public establishment near the universal exposition. It is now no longer in existence, but doubtless we shall soon have an opportunity of seeing it again at our fete day shows.

The realization of this optical illusion, however, is one of the simplest of matters, and requires the use of but very elementary material.

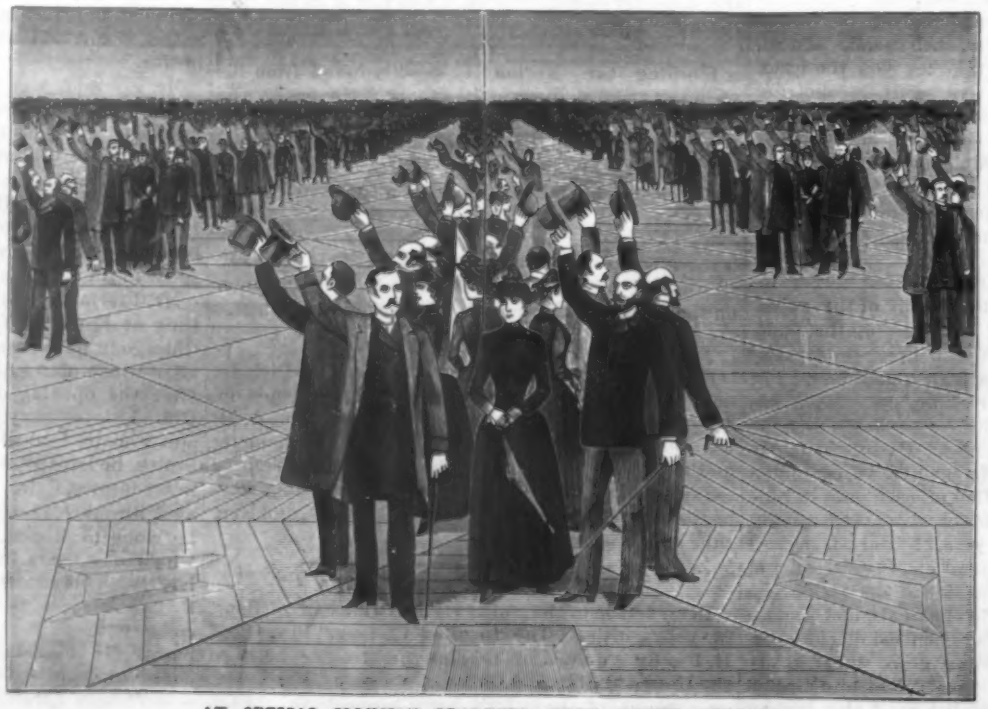
Let us imagine that three perfectly plain and very clear mirror glasses, as large as possible, form a prism whose base is an equilateral triangle. A person placed in the interior of this prism will see his image reflected a very large number of times. A very simple geometrical construction, and one which we recommend our young readers to carry out as an exercise in optics, by the simple application of the principle that the angle of incidence is equal to the angle of reflection, allows us to see that the image of any point whatever placed in the center of this triangle of glass plates will be reproduced indefinitely by groups of six images distributed symmetrically around points regularly spaced in the prolongations of the planes of the three glasses.

A person, therefore, sees his image reproduced indefinitely in groups of six until, the successive reflections attenuating the intensity of the images, the latter cease to be visible. Three or four persons massed in one of the angles present the illusion of a compact and mixed crowd standing upon a sidewalk and awaiting the passage of a procession. The hats waving in the air convert the peaceful waiting into an enthusiastic manifestation, which is so much the more surprising in that it is made by but half a dozen persons at the maximum.

The accompanying figure gives an idea of this remarkable effect, and the three persons, whose images reflected *ad infinitum* produce the curious result that we call attention to, would have much trouble to believe that they were the subject of an illusion.

Upon the whole, the experiment is nothing more than an application of the principle of the old kaleidoscope enlarged and revived, in the sense that the observer has before his eyes the successive reflections of his own image, and that the objects are replaced with living beings movable at will.

Five or six persons may occupy, at the same time, the triangular prism, of which the sides are about six feet wide, and which they enter through a trap in the floor. When these five or six persons are walking about in all directions, they present the aspect of a tumultuous and agitated crowd commenting upon grave events.—*La Nature.*



AN OPTICAL ILLUSION PRODUCED WITH THREE MIRRORS.

An Unknown Gas.

Passing Stratton ice works a short time ago, about 6 o'clock, a reporter saw Mr. Ware, one of the proprietors, on top of the huge ammonia machines, intently watching a long jet of flame which was consuming the gas as it issued from a half inch vent pipe in the top of the machine. Inquiring what kind of light it was, the reporter was informed by Mr. Ware that he did not know anything further than that it was gas which, by some mysterious process, is generated in the "absorber" during the process of ice making with ammonia, and which often creates such a back pressure as to necessitate prompt attention in giving it vent to relieve the machine. The gas burns with a dull greenish flame, but is quite combustible; and while the matter was being discussed by them, the supply was exhausted and the flame went out with a sputter. Mr. Ware then said that there would be no more trouble with it for twenty-four hours, when another accumulation would take place. He further said that no chemist had as yet been able to explain the nature of the gas or why it is generated in this manner.—*Pensacola News.*

[The mystery of the above is probably not very deep. The greenish color of the flame at once betrays its ammoniacal nature or the presence of some ammoniacal compound. Under the conditions of pressure, presence of organic matter from lubrication, etc., it is easy to conceive that a combustible gas could be generated which would contain enough ammonia to give a green color to the flame. Examination by a competent chemist would soon determine the composition of the gas.—ED. S. A.]

A Grand Prize to the Worthington Pumping Engine Company.

In our list of awards at the Paris exhibition, given in SUPPLEMENT, Nos. 722 and 723, the award of a grand prize to the above company was in some way omitted. We are glad now to make the correction.

AN IMPROVED DISH DRIER.

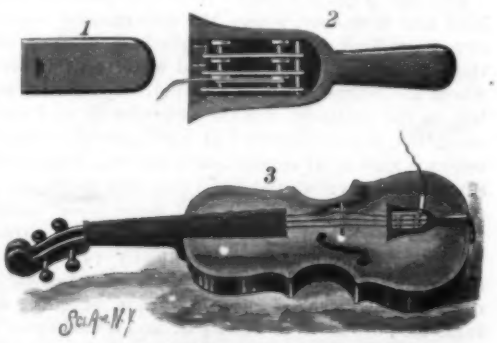
A drier designed to save the work of wiping dishes has been patented by Mrs. Alice J. Wilson, of Abilene, Texas, and is shown herewith. It has a perforated hinged cover, and in its base is held a perforated false bottom, a spout leading from the chamber thus formed, by means of which the drainage water accumulating there may be poured off. A curved projecting piece

MRS. WILSON'S DISH DRIER.

of sheet metal is secured to the side of the body to form a chamber in which knives, forks, and spoons may be placed to drain and dry. Uprights attached to the false bottom support cross pieces, against which the dishes to be dried are placed. The dishes are washed, turned down in the drier, and hot water poured over them, when the cover is closed and the heat remaining will effect the drying and give a glossy appearance, the steam passing off through the perforations of the cover.

AN IMPROVED VIOLIN TAIL PIECE.

In most cases the breaking of violin strings takes place near where the fingers come in contact with the



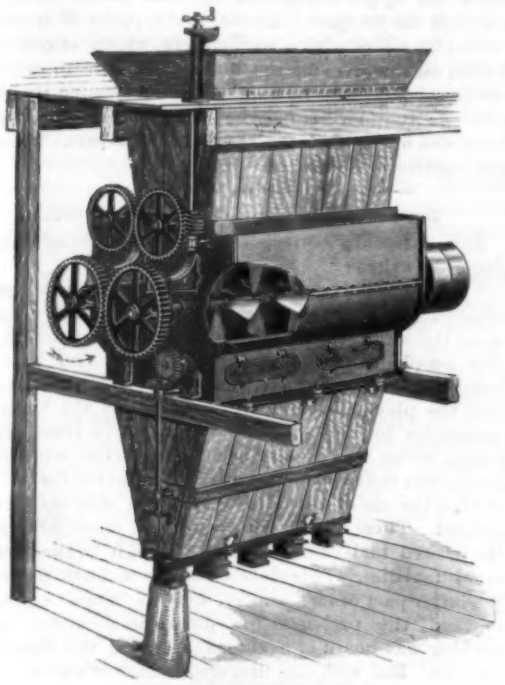
SNOW'S VIOLIN TAIL PIECE.

strings in playing, the broken string being then useless if it consists only of one length. To avoid this waste several lengths of string are sometimes coiled about the tail piece, a portion to be uncoiled at each breakage, but this arrangement is awkward and unsightly, and to overcome the difficulty is the object of an invention illustrated herewith, which forms the subject of a patent issued to Mr. F. P. Snow, of Portland, Oregon. The tail piece has a chamber in its larger part, closed by a sliding cover, shown in Fig. 1, and in this chamber metal plates or bars lie parallel, as in Fig. 2, these plates being all pivoted at one end. The free ends of the plates are held in suitable recesses, but so that such ends can be swung upward when desired, as shown in Fig. 3, and each plate has on its side two studs, each plate with its studs forming a kind of bobbin around which the string is wound in an elongated coil. The chamber in the tail piece is preferably made with a bottom, and the whole mechanism inclosed, the strings passing out from the chamber through small channels or recesses. Usually but three bobbins are employed, the G string being attached to the tail piece by passing it through a concealed hole and tying a knot in its end.

A CITY ordinance lately passed at Cleveland, and which gives popular satisfaction, forbids the blowing of steam whistles. The manufacturers find that the use of the screechers is not necessary.

AN IMPROVED MECHANICAL MIXER.

The accompanying illustration represents a mixer, patented by Mr. Milton Broughton, expressly designed to thoroughly mix patent wall plaster, and equally suitable for mixing fertilizers, sand, lime, cements, etc. The machine is represented as occupying a portion of two floors of a building. The material to be mixed is received in the hopper-like top portion of the machine, in the bottom of which are two iron doors, the doors being attached to shafts geared together outside of the casing, a worm meshing into one of these gears and attached to a vertical shaft having a handle on its upper end affording ready means for opening and closing the doors and regulating the feed as desired. In the mixing chamber, the interior of which is seen through the partially broken away casing, are two horizontal shafts geared together to run side by side in opposite directions, paddles being placed upon the shafts in screw



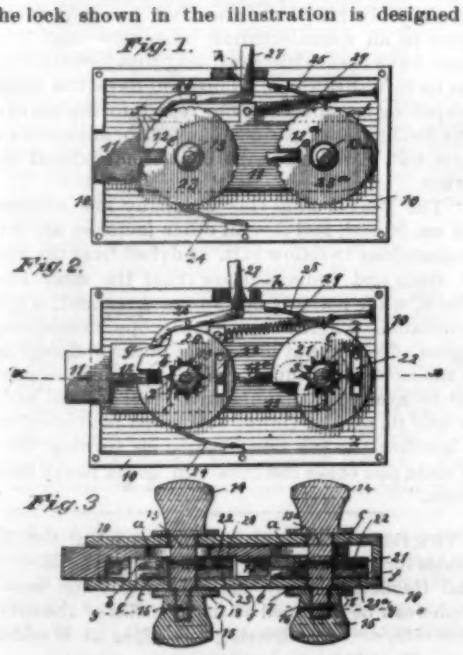
THE BROUGHTON MIXER.

form, so that as the shafts are rotated, the material is lifted and thrown in opposite directions from one end of the case to the other, the constant motion insuring a thorough mixing. After the completion of the operation the material is dropped into a lower receiving chamber by means of two sliding doors that run on ways and open directly under the center of each set of paddles, the shaft connected with these sliding doors being connected by a gear with a rod having a hand wheel, whereby the operator may conveniently remove the material to bags or other receptacle provided therefor. The upper doors controlling the feed to the machine may also be connected to be operated from the same point. The doors from the receiving chamber are easily accessible and readily adjustable through openings in the sides of the case, and the edges of these doors are steel ground to a knife edge in shear form, so that they will cut fiber or any other light obstruction. The mixing chamber and all working parts are of iron and steel, making the machine solid and durable, and easy to operate.

This machine is manufactured by Messrs. Alexander, Bradley & Dunning, of Syracuse, N. Y.

AN IMPROVED COMBINATION LOCK.

The lock shown in the illustration is designed to afford increased security, as compared with other locks of this class, and at the same time be more simple in construction. It has been patented by Mr. George M. Douglass, of Benedict, Neb. Fig. 1 is a sectional view, with the bolt retracted, Fig. 2 being a similar view with the bolt in locking position and one set of the operating disks removed, while Fig. 3 is a central longitudinal sectional view. The bolt, 11, has projections, 12 and 12*a*, on one side, and two longitudinal slots through which pass spindles, 13 and 13*a*, having knobs, 14 and 15, there being in connection with each of the knobs a dial and pointers upon the lock case. Upon spindle 13, as shown in Fig. 2, is mounted a disk having a slot, *b*, this disk being held to turn with the spindle by a pin engaging one of a series of notches formed in star shape centrally in the disk, and upon spindle 13*a*, shown in the same figure, is a disk with a recessed peripheral face, one side of the recess corresponding with the slot, *b*, and having adjacent thereto a cam face. In the side faces of these disks are spring tongues, 22, adapted to engage the slots, *e*, of other disks, 23 and 23*a*, shown in Fig. 1, the latter disks being loosely mounted on the spindles, and having notched peripheral faces. These notches are adapted to be engaged by spring fingers, 24 and 25, preventing retrograde movement of the disks. Upon one side of the bolt is a notch, *g*, whereby the bolt when thrown may be engaged by a lever, 26, pivotally mounted in the case, and having a thumbpiece, 27, extending outward through a slot in the upper wall of the case. The bolt is normally held retracted by a spring, 29. To draw the bolt, the operator, understanding the combination, turns the knob to bring the spring tongues on the disks shown in Fig. 2 into engagement with the slots, *e*, on the disks shown in Fig. 1, the motion being continued until the slots are brought into line with the projections on the bolt. The motion of the knob is then reversed until the slot, *b*, of the disk, 20, and the recess, 3, of the disk, 21, register with the projections on the bolt, when the spring, 29, draws the bolt. The bolt is thrown by turning the spindle, 13*a*, to bring the cam face of the disk, 21, against the rear lug on the bolt, when the bolt is locked by means of the lever, 26.



DOUGLASS' COMBINATION LOCK.

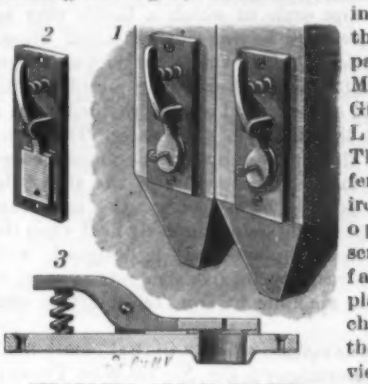
REVERSING ATTACHMENT FOR TYPE WRITERS.

The accompanying illustration represents an attachment for type-writing machines whereby, as a line is completed, the carriage is drawn back to its original position, and the paper turned up for a new line, simply by moving a lever, that is in convenient position to be pressed against by the knee, the hands not having to be removed from the keys. The invention has been patented by Mr. George Gledhill, law reporter, of Oswego, Kansas. The attachment is shown applied to a Remington machine, Fig. 2 showing that part of the upper end of the attachment connected with the machine. Its base piece may be secured to the type writer direct, or to the stand upon which the machine rests, by means of a spring clamp at one end and ordinary screws in other places. A shaft is journaled parallel with the base piece, a short arm projecting outwardly and upwardly from the shaft being connected by a link with one arm of a bell crank lever pivotally secured on the under side of the clamp, the other arm of this lever forming a downwardly extending handle in convenient position to be pushed by the knee, by means of which the shaft parallel with the base piece is turned through part of a revolution. From the other end of this shaft projects a longer arm which is connected with the carriage of the machine by means of a strap and a bell crank tripping lever, pivotally secured to the side of a collar fitting on the support for the paper table. The arrangement is such that when the lever below the machine is moved from right to left by the knee of the operator, the shaft parallel with the base piece is rotated, swinging outward the arm projecting from its farther end, and drawing the carriage after it, the cord or strap connecting the arm with the carriage permitting the arm to move in the arc of a circle. For turning up the paper for a line space, a lug is attached to the rear end of the line space handle, the point of the lug projecting below the tripping lever, which engages with the top of the lug whenever the tripping lever is swung downward upon its pivot. The leverage of this lever is so great that before the carriage starts upon its return trip the roller is turned up one or more spaces, as desired, this being regulated in the ordinary manner for a greater or less space between the lines. When the carriage is drawn back, and the pressure of the knee released, the tripping lever is raised by the mechanism of the machine for retracting the line space mechanism for a new line.

It is said that this attachment has been proved entirely practical in actual use, the operator not having to touch the line space handle except to put in a fresh supply of paper.

AN IMPROVED ORGAN PALLET.

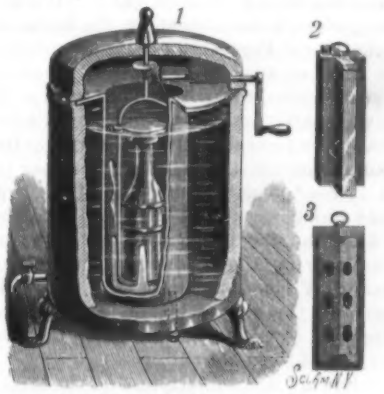
The accompanying illustration represents a metallic pallet for organs, constituting a new article of manufacture, which can be cheaply made in large quantities and kept on hand by organ makers, to be used when building the organ, instead of wooden pallets. The invention forms the subject of a patent issued to Mr. Gaspard O. Girardin, of Lake Linden, Mich. The base is preferably of cast iron, with an air opening and screw holes for fastening the plate to the wind chest, as shown in the sectional view, Fig. 3. On the under side of the base are lugs between which is pivoted a lever having near one end a lug on which is held one end of a coiled spring, the other end of the spring resting around a similar lug on the base. The end of the lever opposite the spring carries the valve proper, adapted to open and close the air opening, the valve being pressed against a seat of leather or other suitable material. In the middle of the valve is a small hole for fastening a hook or loop, as shown in the perspective view, Fig. 1, and generally used to hook on pull downs. Fig. 2 shows a modified form of the pallet with an oblong air opening and correspondingly shaped valve, for sound boards requiring channels on account of the slides for the different stops.



GIRARDIN'S ORGAN PALLET.

AN IMPROVED FAMILY ICE MACHINE.

A simple and easily operated machine for making ice, ice cream, iced champagne, cooling water for drinking, etc., is shown herewith, and has been patented by Mr. Paul L. Dermigny. Fig. 1 shows the machine with a bottle in place for cooling, Fig. 2 being an ice mould and Fig. 3 an ice cream mould, to be substituted for the bottle when desired. An inner receptacle is placed within an outer one to form a space between them to hold water to be cooled, a faucet at the lower end affording means for drawing the water as needed. The upper end of the inner receptacle has an outwardly extending flange forming a cover over the water space, and there is here a covered opening for introducing water to the water space, there being also an outlet pipe leading from the bottom of the inner receptacle, which may be charged with any suitable freezing mix-



DERMIGNY'S FAMILY ICE MACHINE.

GLEDHILL'S ATTACHMENT FOR TYPE WRITERS.

ture, such as sulphate of soda and hydrochloric acid. The inner vessel is charged with the freezing mixture by removing the cover of the outer receptacle. Centrally in the bottom of the inner receptacle is a spindle on which is the disk of an agitator mounted to turn in the freezing mixture. The disk preferably has short upwardly extending arms in which a bottle may be placed, and longer arms having side agitating wings, which join a vertical shaft in the upper part of the receptacle, this shaft having a bevel gear meshing with the bevel gear of a horizontal shaft provided with a crank handle on the outside of the freezer. The bottle is firmly held in the agitator by a cone-shaped cover secured on an arm sliding vertically on the side rods, and adjusted in position by set screws, the ice cream mould and the ice mould being similarly held when the freezer is to be thus employed. It is designed, with the use of comparatively inexpensive refrigerants, to make ice in this machine in from ten to fifteen minutes.

For further information relative to the invention address Messrs. L. Dermigny & Co., No. 126 West Twenty-fifth Street, New York City.

A Norwegian Settlement in Massachusetts Five Hundred Years before Columbus.

Watertown, Mass., one of the oldest towns in Massachusetts, celebrated on Nov. 24 the discovery of the ancient town or city of Norumbega by Professor Eben Norton Horsford, of Harvard University. The exercises were held under the auspices of the American Geographical Society at the tower erected near the junction of Stony Brook with Charles River, which marks the spot where the remains of Norumbega are said to have been discovered, and consisted of a sketch of the researches of Professor Horsford; an address by Judge Daly, president of the society; a Swedish folk song by Madam Zela; poem by Mr. E. H. Clement; and a hymn composed by Miss Louise Manning Hodgkins, and sung by a choir from Norumbega Hall, Wellesley College.

At the opening of the exercises Professor Horsford made the following announcement: "It is now nearly five years since I discovered on the banks of Charles River the site of Fort Norumbega, occupied for a time by the Bretons some four hundred years ago, and many years earlier still built and occupied as the seat of extensive fisheries and a settlement by the Northmen. It is nearly five years since the discovery was the subject of a communication which I had the honor to address to you, in your official capacity, on the first of March, 1885, and which was published in the October bulletin of the American Geographical Society of the same year.

"I have to-day the honor of announcing to you the discovery of Vinland, including the Landfall of Leif Erikson and the site of his houses. I have also to announce to you the discovery of the site of the ancient city of Norumbega."

The following is the inscription on the tablet let into the tower:

"A. D. 1000. A. D. 1889. Norumbega. City: country: fort: river. Norumbega = Nor'mbega. Indian utterance of Norbega, the ancient form of Norvega, Norway: to which the region of Vinland was subject. City at and near Watertown. Where remain to-day docks, wharves, walls, dams, basin. Country extending from Rhode Island to the St. Lawrence. First seen by Bjarni Herjulfson, 985 A. D. Landfall of Leif Erikson on Cape Cod, 1000 A. D. Norse canals, dams, walls, pavements, forts, terraced places of assembly, remain to-day. Fort at base of tower and region about was occupied by the Breton French in the 15th, 16th, and 17th centuries. River the Charles discovered by Leif Erikson 1000 A. D. Explored by Thorwald, Leif's brother, 1003 A. D. Colonized by Thorfinn Karlsefni 1007 A. D. First Bishop Erik Gnupson 1121 A.D. Industries for 350 years. Masur-wood (burs), fish, furs, agriculture. Latest Norse ship returned to Iceland in 1347."

Prof. Horsford recounted narratives of Verrazano, Parmentier, and other explorers, relating to the reported existence of the remains of Norumbega as somewhere between the site of Gloucester and the headwaters of the Charles. The name appeared on their maps.

There are monuments of the presence of the Northmen, said Prof. Horsford, on every square mile of the basin of the Charles. As evidences of this he alluded to the canal walled on one side for a thousand feet along the west side of Stony Brook and to the dry canal near Newtonville. There were also remains of canals, ditches, deltas, boom dams, ponds, fish traps, dwellings, walls, and amphitheaters scattered all throughout the basin of the Charles.

IN the suit in the Eastern District, of the Bridgeport Wood Finishing Company *vs.* New York Wood Finishing Company and others, for infringement of the celebrated Wheeler patent covering the use of ground silex, quartz, feldspar, etc., in a wood filler, subpœnas have been served on all the defendants, citing them to answer on the first Monday of November, 1889. Application for an injunction, during the pendency of the suit, will be made to the court.

HEAT.*

Heat is the manifestation of an extremely rapid vibratory motion of the molecules of a body. An increase in the velocity and amplitude of the vibrations increases the temperature of the body. A heated mass can impart vibratory motion to the ether which fills space and permeates all bodies, and these wave motions of the ether are able to reproduce in bodies motions similar to those by which they were caused.

The more obvious effects of heat are expansion, fusion, and vaporization. All bodies increase in volume when heated, gases being the most expansible, liquids next, and solids the least. Heat may partially or wholly balance molecular attraction. Hence it is that,

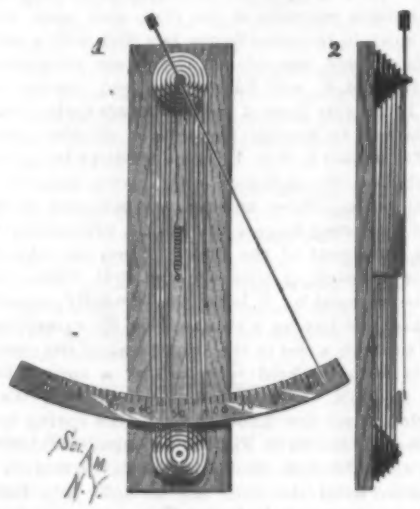


Fig. 1.—METALLIC THERMOMETER.

when heated, solids first expand, then (if no chemical action occurs) soften and become liquid, and finally vaporize. Liquids are changed into vapors, and gases are rarefied.

EXPANSION.

Expansion takes place in all directions. To render this phenomenon apparent, an elongated and attenuated body, such, for example, as a fine wire, is chosen and its linear expansion only is noted. Fig. 1 shows an instrument for exhibiting the linear expansion of a long thin wire, 1 and 2 being respectively front and side views. The instrument is provided with two series of hard rubber pulleys mounted on studs projecting from a board. A fine brass wire (No. 32) attached to the board at one end passes around the successive pulleys of the upper and lower series in alternation, the last end being connected with one end of a spiral spring, which is strong enough to keep the wire taut without stretching it. The other end of the spring is attached to a stud projecting from the board. The pulleys are of different diameters, so that each series forms a cone. By this construction the wire of one convolution is prevented from covering the wire of the next.

The last pulley of the upper series is provided with a boss, to which is attached a counterbalanced index. A curved scale is supported behind the index by posts projecting from the board.

The series of pulleys are 12 inches apart, and there

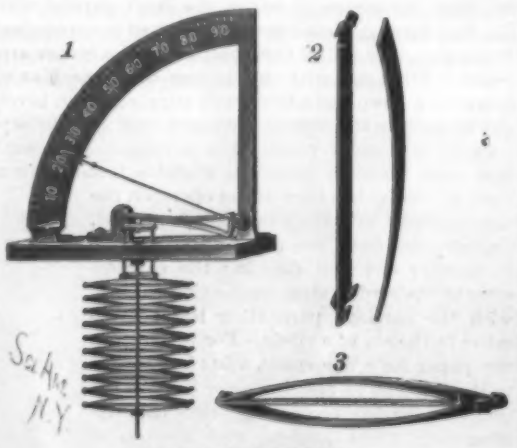


Fig. 2.—THERMOSTAT.

are ten convolutions of wire, so that a small change of temperature produces sufficient expansion of the wire to cause a perceptible movement of the index. To increase the sensitiveness of the instrument, the wire is blackened by means of smoke or dead black varnish. An electric current passing through the wire heats it sufficiently to cause a deflection of the index, the amount of deflection depending, of course, upon the strength of the current.

Fig. 2 shows a simple thermostat which is capable of many useful applications. It is represented with an index and scale, but these are not essential for most purposes.

The instrument depends for its operation on the difference between the expansion of brass and steel. The linear expansion of brass is nearly double that of steel, so that when a curved bar of brass is confined at the ends by a straight bar of steel, the brass bar will elongate more than the steel bar when both are heated, and will in consequence become more convex.

At 2 are shown two bars, the straight one being of steel, the curved one of brass. The steel bar is slit for a short distance in two places at each end, and the ears thus formed are bent in opposite directions to form abutments for the ends of the curved brass bars, two brass bars being held by a single steel bar, thus forming a compound bar, as shown at 3. Each compound bar is drilled through at the center. Ten or more such compound bars are strung together loosely upon a rod, which is secured to a fixed support. A stirrup formed of two rods and two cross pieces rests upon the upper compound bar and passes upward through the support. Above the support it is connected by a link with a sector lever which engages a pinion on the pivot of the index. The use to which the thermostat is to be applied will determine its size and construction. It may be used in connection with kilns and ovens and for operating dampers, valves, and electric switches.

Decline of Natural Gas at Pittsburg.

The Pittsburg correspondent of the Philadelphia *Inquirer* writes:

"The fact that the natural gas supply in this and adjoining districts has passed the zenith and is now upon the wane can no longer be satisfactorily denied. The people, from the wealthy manufacturer to the humblest employe, have been hoping against hope that the plausible explanations given by the various companies for the shortage would prove true. The reason which has usually been given to the inquiring public was that new mains were being laid to the wells, or that the size of those already down was being increased. These changes have all been made, and still the desired fuel does not pour through in the necessary quantities. This state of affairs was first noticed the latter part of last winter, but the warm weather relieved the pressure for domestic purposes, and nothing was heard of a shortage during the summer months. But with the first appearance of a change of temperature this fall, the trouble recommenced in an aggravated form.

"The last move of the natural gas companies has been to ask the big mills to run only at night, when the demand upon the fuel for other purposes would be light. This request was vehemently opposed by the employes affected, and no satisfactory settlement has yet been made. Many of the establishments have decided to return to the use of coal, and some have already done so. But even under these circumstances, the supply at night is not sufficient, as several newspaper offices in the city could bear testimony if they so desired.

"All of the electric light plants in the city were forced to suspend operations for a time, the other night, because of a lack of power, and the inconvenience and annoyance, not to speak of positive financial loss, has been great in many instances. The apparent result of the whole trouble will be that natural gas will be transformed from an ordinary fuel into a luxury. There will probably be enough for residence use for years to come, and those who can afford it will have it, because of its superiority to coal, notwithstanding the difference in price.

"This condition prevails not alone in Pittsburg, but in the surrounding districts. In the Beaver Valley the Citizens' Gas Company announced an advance of about 11 per cent over last year, and a Bridgewater company has not only raised its rates, but has issued and ordered to all manufacturing consumers that all contracts have been withdrawn and that hereafter no gas can be furnished them. This will have the result of compelling manufacturers to return to the use of coal. The Bridgewater gas company also announces that none but dwellings will be accommodated in the future.

"The Beaver Falls Gas Company has returned to the use of coal, and several other factories are making preparations to follow suit. Advices from the gas belt of Ohio and Indiana show that the same state of affairs, while possibly not so far advanced, is already noticeable. There is a general hope throughout the region affected that in the case of the practical failure of the natural gas supply, which it is now conceded can not be averted, a manufactured fuel gas will be found to take its place. Unless some such plan is successful, it is difficult to see how companies owning the miles of main and other facilities can avoid heavy financial losses."

THE tide tables for the Atlantic coast of the United States for the year 1890, published by the U. S. Coast and Geodetic Survey, are now ready for issue, and copies can be obtained at the agencies of the survey in this city, or by addressing the office at Washington. Price 25 cents.

* From "Experimental Science," by George M. Hopkins. Munn & Co. publishers, New York.

THE NEW DRY DOCK, BROOKLYN NAVY YARD.

The pioneer in the building of timber graving docks was Mr. J. E. Simpson, the senior member of the firm of J. E. Simpson & Co., of this city. For many years he upheld the superiority of wood over stone for these structures. The points made in their favor are numerous. Their original cost is comparatively low. They resist the action of frost much better than do stone docks, whose members are apt to be dislodged by successive winters. Hence the repairs required are less than for stone structures. From the standpoint of practical working they possess valuable features, when constructed upon Mr. Simpson's system. The material is safer and better for the workmen than is stone. The steps are so low that they can easily be mounted. As they entirely surround the dock, no choice of a place to go to or from work is needed. In severe weather ice is not so liable to form and remain upon wood as on stone.

Thus it is clear that many practical points of merit can be cited. At first sight they would appear of a more temporary character than stone, yet this does not seem confirmed on examination. The first dock of this type was built in Boston in 1853 and 1854. It is still in use and in fair condition. Less than two years later a second dock was completed there. After constant service for twenty years with but slight repairs, part of the woodwork was rebuilt. But this rebuilding only refers to the alters or facing pieces, as the original piles, floor timbers, and abutments are still in use.

The Brooklyn Navy Yard dock, which we illustrate, is one of three contracted for the government by this firm. Hitherto the United States naval authorities have favored stone as the material for graving docks. When they began to consider the expediency of erecting wooden docks, boards of inspectors were appointed by the Secretary of the Navy, to examine existing timber docks, and to report upon the advisability of building such structures for the navy yards. In accordance with the recommendations of these investigators, timber docks were started at three navy yards, at Portsmouth, Va., League Island, Pa., and Brooklyn, N. Y.

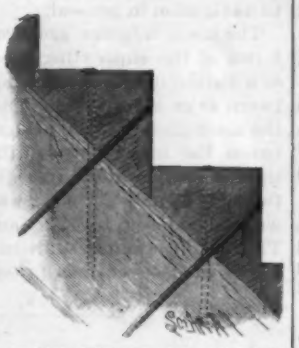
The dock represents an excavated basin or slip lined throughout with Georgia pine timber, with sides and inner end sloping to the floor. The outer end is open, and is provided with heavy sill and abutment timbers. An iron caisson fits this opening and acts as a gate. The general dimensions are as follows: Length over all on coping, 530 feet; length over all inside of caisson, 500 feet; width on top amidship, 130 feet 4 inches; width on floor amidship, 50 feet; width on floor at entrance, 53 feet; width on top at entrance, 85 feet; depth of gate sill below coping, 30 feet 6 inches; depth of gate sill below high water, 25 feet 6 inches; depth at center, 33 feet 8 inches.

It will be seen that the sides at the ends are brought together, thus economizing pumping. The general outline conforms in some degree to the outline of a ship. The visible part of the dock is by no means all of it. A great part of the structure is hidden away under ground, the whole being surrounded by close sheet piling that lies twenty-six feet back from the coping.

The structural features are shown in cross section in the cut, one-half only of the dock being included. At the bottom is the floor, fifty feet wide by four hundred and sixty feet long. Around the periphery of this area eight-inch tongued and grooved sheet piling is driven. In good ground the practice has been to drive this down seven and one-half feet. But on account of quicksand, it was driven down forty-five feet in the present instance. The area included within this sheet piling contains round piles, driven in rows, three feet between centers transversely, and four feet in the direction of the length of the dock. Each row of piles carries a longitudinal square timber of Georgia pine. Upon these rest cross timbers three feet between centers, and the planking for the bottom is spiked or bolted to these. This planking is three inches thick. Special rows of piles are driven to carry the keel blocks; a space ten feet wide beneath the center of the dock contains extra closely spaced piling for this purpose. The timber used is in general about one foot square, and the piling twelve inches in diameter.

Under the floor and surrounding the heads of the piles is a bed of Portland cement concrete, five feet thick at the center, and rising toward each side between the transverse timbers to the height of one foot, giving a maximum thickness of six feet. Any water which may find its way thereto runs down to the central axis of the dock, owing to this slope.

From each side of the floor the sides rise in steps with a slope of eight upon ten, or about 39°. They are lined with pieces of ten-inch plank, eleven inches in greatest height, but chamfered off at their rear and lower corner, so that their vertical rear face is only three inches high. They run horizontally around the dock, forming steps eight inches high and ten inches wide upon the parallel sides. These pieces are termed alters. They are of Georgia pine. They are bolted to side brace timbers that rise, following the same slope from the edge of the flooring. Where the alters cross these timbers, the bolts are driven; one bolt passes through the center of the timber vertically, a second one is driven through the face of the alter diagonally, so as to enter the brace timber perpendicularly. The lower ends of the brace timbers abut upon the floor timbers and also against square longitudinal timbers bolted to the floor and representing the bottom alter. Four piles support each brace timber at equidistant points of its length. A mass of concrete rises six feet up the side, back of the alters, running from two to five feet in thickness. Above this the space back of the alters is rammed with clay, so as to be filled with a compact and almost impervious puddle.



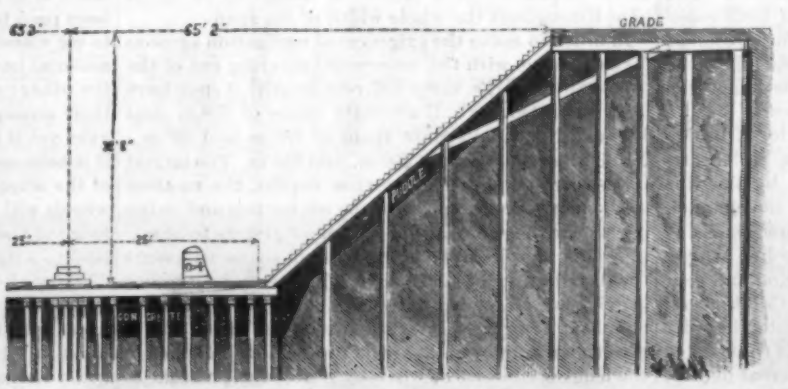
CROSS SECTION OF ALTERS.

Upon every third floor timber oak bearers are bolted, upon which the bilge blocks slide.

From the interior lines of coping the dock, as stated, is one hundred and thirty feet four inches wide, and twenty-six feet back from this coping line tongued and grooved sheet piling is driven well below the floor level of the dock, so as to completely surround it. This gives a total width of one hundred and eighty-two feet four inches. Four rows of piling with cross caps are driven within this area between sheet piling and coping, and diagonal braces are carried from the center of these caps to the center of the cross brace timbers that carry the alters.

The dock is closed by a floating caisson. This is an iron vessel with sloping stem pieces that exactly fits the dock entrance. A heavy India rubber packing is carried around the entrance sills and abutments against which the caisson bears. No grooves are used, the working of the dock being thus greatly facilitated. Two sills are provided, an outer and inner one. This is to enable repairs of the inner or main sill to be attended to, as this is the one most used. The caisson can close the dock from either sill.

Very powerful pumping machinery is provided for emptying the dock. It consists of two centrifugal pumps of 42 in. diameter, driven by two vertical engines 28 in. diameter of cylinder by 24 in. stroke. Three Scotch steel boilers 13 ft. in diameter by 11 ft. long supply steam. The Southwark Foundry and Machine Co., of Philadelphia, supply the pumping plant. The pumps have a capacity of 80,000 gallons a minute, and can empty the dock in ninety minutes when no vessel is in it. If a ship is docked, the time required will be proportionately less. Open sluiceways are provided that are made in the concrete under the floor timbers on each side of the keelway. These lead to a drainage culvert and pumping well near the front of the dock on one side. The suction pipes run thence to the pumps. This supplies means for emptying the dock. The filling is done through the caisson. Culverts, with valves, run through its body transversely. Several flood gates 23 in. in diameter are provided, operated by hand wheels. Thus the filling can be extremely rapid.



PLAN OF DOCK.

The caisson is raised and lowered by pumping out or admitting water ballast, a small boiler, engine, and rotary pump being contained within it. The same engine works a capstan on its deck. Work was begun upon the dock about Dec. 16, 1887, possession of the ground having been acquired one month earlier. It is hoped that it will be completed by Feb. 1, 1890.

MR. CHAS. A. SCHIEREN, of the firm of Chas. A. Schieren & Co., has been appointed one of the committee for the International Exposition of 1892, to represent the leather belting industry.

Tomatoes.

The following is a summary of the results with tomatoes at the Cornell University Agricultural Station, I. P. Roberts director:

1. Frequent transplanting of the young plant, and good tillage, are necessary to best results in tomato culture.

2. Plants started under glass about ten weeks before transplanting into field gave fruits from a week to ten days earlier than those started two or three weeks later, while there was a much greater difference when the plants were started six weeks later. Productiveness was greatly increased by the early planting.

3. Liberal and even heavy manuring, during the present season, gave great increase in yield over no fertilizing, although the common notion is quite to the contrary. Heavy manuring does not appear, therefore, to produce vine at the expense of fruit.

4. The tests indicate that poor soil may tend to render fruits more angular.

5. Varieties of tomatoes run out, and ten years may perhaps be considered the average life of a variety.

6. The particular points at present in demand in tomatoes are these: Regularity in shape, solidity, large size, productiveness of plant.

7. The ideal tomato would probably conform closely to the following scale of points: Vigor of plant, 5; earliness, 10; color of fruit, 5; solidity of fruit, 20; shape of fruit, 20; size, 10; flavor, 5; cooking qualities, 5; productiveness, 20.

8. Solidity of fruit cannot be accurately measured either by weight or keeping qualities.

9. Cooking qualities appear to be largely individual rather than varietal characteristics.

10. The following varieties appear, from the season's work, to be among the best market tomatoes: Ignotum, Beauty, Mikado, Perfection, Favorite, Potato Leaf.

11. The following recent introductions appear to possess merits for market: Bay State, Atlantic, Brandywine, Jubilee, Matchless, and, perhaps, Lorillard, Prelude, and Salzer.

12. The following recent introductions are particularly valuable for amateur cultivation: Dwarf Champion, Lorillard, Peach, Prelude.

Electric Light Companies Everywhere.

A gas and electric light and power company is about to be established in Monson, Mass., a town of about 5,000 inhabitants, situated on the New London and Northern Railroad, four miles south of Palmer and fifteen miles east of Springfield.

George H. Newton will be president, and Thomas F. Robinson treasurer of the new company. The capital will be $20,000, and the stock is to be taken by the business men of the place. Monson has long been noted for its academy of learning and for its extensive cotton and woolen factories. Ladies' woolen dress goods, men's straw hats, and ladies' straw bonnets are manufactured in large quantities, and it is here the celebrated granite quarries, worked very many years by the Flynt family, are located.

Japanese in China.

A remarkable phase in the recent industrial developments in China, says *Industries*, is the increasing number of Japanese employed in engineering works and manufactures. "It is now almost twenty years since Japan made a start in modern industry, and not only did it start works under the superintendence of foreigners, but it commenced at the foundation, and instituted schools and colleges for the training of natives in the arts and sciences, and now, to a large extent, it is independent of foreign assistance in this respect, and almost all the works of which we hear so much are designed and manufactured by natives. In China there have been a few schools or colleges started with the same objects, but they have never been carried out with that thoroughness which is necessary for real success.

We understand that at present the Chinese government is on the outlook for several capable men to go to Pekin as professors in different departments of pure and applied science. During the past year a considerable number have been engaged in similar capacities in the various arsenals, where schools for the training of young Chinese have been established. In the meantime, however, the supply of qualified Chinese is very limited, and some of the local governors, who have not been able to get over their dislike to Europeans, have engaged a considerable number of Japanese engineers, especially for mines and some departments of manufacture. In some cases even we understand that Japanese have been engaged as instructors in applied science, and, although able to understand the Chinese books, they cannot speak the language; and we have the curious spectacle of the younger Oriental nation teaching the older nation through the medium of the English language—a very odd phase in the history of civilization.

THE PROPOSED BRIDGE OVER THE ENGLISH CHANNEL.

The idea of connecting England with the Continent by a bridge is not new. It has from the beginning of this century occupied the minds of a great number of distinguished men, but the labors of M. Thome de Gamond particularly contributed to render the idea popular. The problem is at present clearly placed before the technical authorities of both countries.

The preliminary projects submitted by MM. H. Hersent, Schneider & Co., and Fowler & Baker, at the meeting of the Iron and Steel Institute, Paris, 1889, consist of separate reports relating respectively to the foundations for the piers to be erected in the sea and to the construction of the superstructure, as well as of a rational statement of the means for placing in position the foundations and spans.

The amount of metal and machinery to be provided for the construction of a bridge over the channel would represent an aggregate weight of about 1,000,000 tons. The assumption is that each country will have to supply one-half of this amount, which on either side would for a lengthy period give a powerful impulse to the development of national industry.

An approximate idea, as far as can be possibly formed by a rough calculation at first sight, assuming that the distribution of spans shown in the engraving is adopted, permits the following figures to be given with reasonable certainty: 380,000,000f. for masonry supports and 480,000,000f. for the metallic superstructure, in all 860,000,000f., or £34,400,000, or $172,000,000. The works for the tunnel and the railways of both countries would have to be planned later on in agreement with the companies whose lines would lead up to the bridge. The time required for the completion of the undertaking may be fixed at about ten years.

The situation which seems preferable for a bridge connecting England with the Continent is, as it were, suggested by nature herself, namely, by the line stretching over the shallowest parts of the channel, and connecting the shores where they are closest to each other. This line commences at a point near to Cape Grisnez and reaches the coast of England near Folkestone, passing over the banks of Colbart and Varne. This arrangement has been adopted in order to enable the existence of these two banks to be taken advantage of, so as to avoid working in great depths, and thereby to diminish the height of the piers to be erected. The ground is found to be sufficiently solid to support very extensive works.

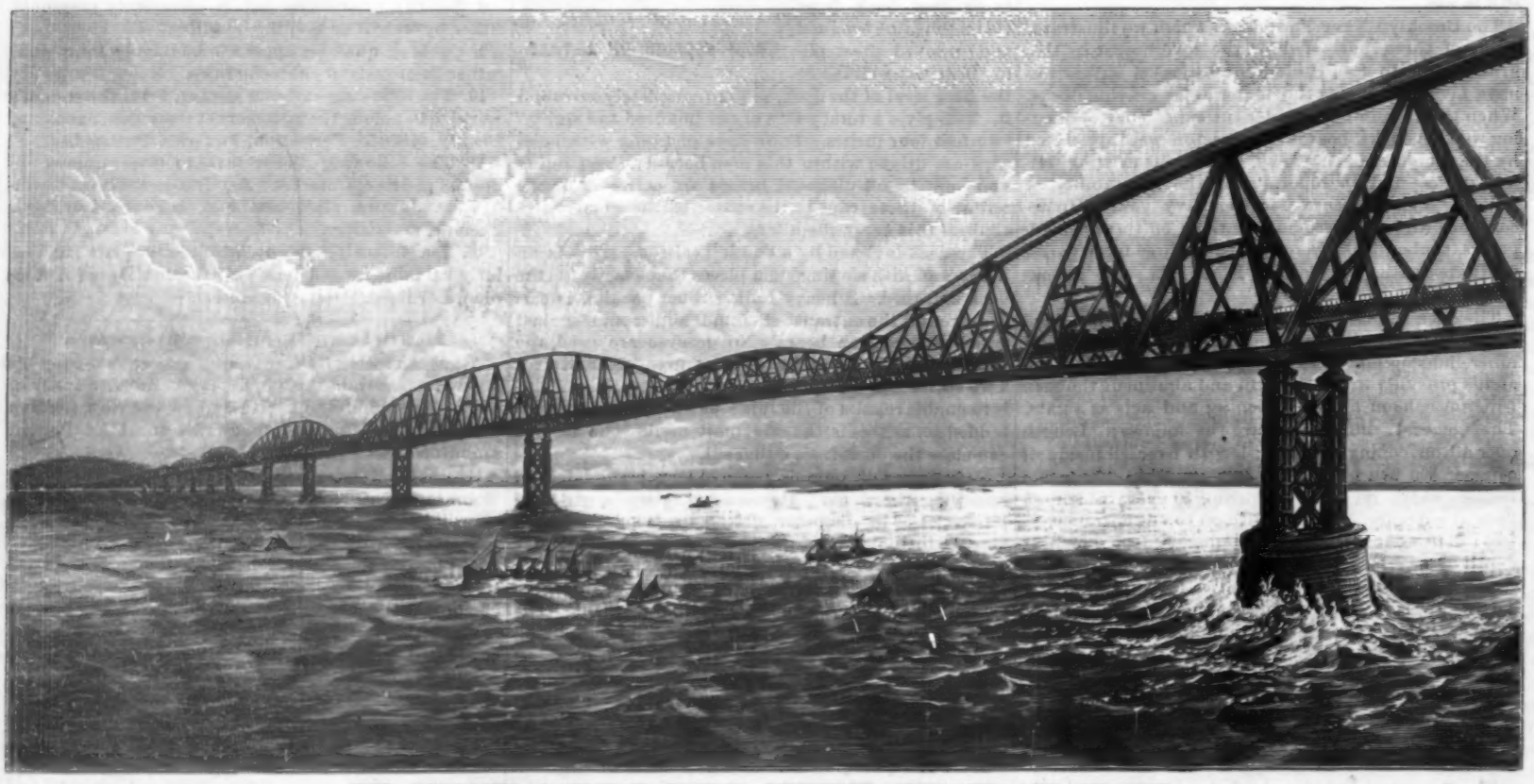
The masonry will be built inside metal caissons similar to those used for ordinary bridge piers, and forced by compressed air down to the solid ground. These caissons, which will be surmounted by metal cases surrounding the masonry, will serve to float the piers until they touch the ground. This will enable the ground to be carefully cleaned, and promote the application of the concrete that is to be interposed between the masonry and the bottom, as will be explained further on. The caisson will, moreover, be surmounted by a movable dome, which will be removed when the upper part of the column is completed, so as to enable the masonry to be carefully finished with squared stones above the level of low water. Special arrangements will be made for joining the columns to the masonry, so that these joints may be at all times readily inspected to ascertain whether anything is out of order in each separate portion of the work.

The distance between the piers, fixed at 500 m. and 300 m. for the large spans, will not be less than 200 m. and 100 m. respectively for the small ones, and will, at all events, be sufficient to prevent their proving an obstacle to the free navigation of sailing vessels. As regards steamships, no such danger is to be apprehended, as the current, which would certainly become a little faster in the center of the open spans, would carry floating bodies, even disabled vessels, toward that part, and prevent their ever touching the bridge. It may, therefore, be reasonably admitted that, owing to these distances and dimensions, the piers would in no way modify the conditions of navigation in the channel, and would certainly not constitute an appreciable obstacle to navigation in general.

The metal columns are firmly placed upon the platforms of the supporting piers of masonry. They are of a distinctly cylindrical shape, and vary in height between 40 m. and 42·780 m., and on them will be placed the main girders of the bridge. There will thus be between the lower parts of the beams and the level of the sea at low water a free space varying in height between 61 m. and 63·780 m., which height at high water will be reduced to 54 m. and 56·780 m. respectively. This height is amply sufficient for the passage of vessels of whatsoever description or tonnage. By placing the floor upon vertical cylindrical columns, the space above indicated, of a minimum height of 54 m., is kept throughout the whole width of the span.

In order to make the exigences of navigation agree as far as possible with the economical carrying out of the preparatory works, three different lengths of span have been proposed. No. 1, alternate spans of 300 m. and 500 m.; No. 2, alternate spans of 200 m. and 350 m.; No. 3, alternate spans of 100 m. and 250 m. The largest spans correspond to the greatest depths, the smallest to the most elevated parts of the sea bottom and to the parts near the shores. The system of girders to be employed is simple, unlatticed, trussed, so as to insure the distribution of all stresses. The secondary beams provided are intended to reduce the length of certain members, to prevent buckling of braced beams, and to give those employed as struts proportions suitable to the lengths concerned, whereby it becomes possible to leave the coefficient of compression, which would increase the weight, out of consideration.

The level of the permanent way is 72 m. above the low water level. This height might have been reduced by arranging the permanent way in the lower portion of the bridge, but in that case it would have been necessary to make the cross beams a great deal larger, and consequently heavier. By raising the permanent way, on the contrary, as it is proposed here to do, a marked economy is attainable, which will certainly not be absorbed by increased expenses involved by the necessity of erecting viaducts at both ends of the bridge. There will be a double set of rails, and the width of the flooring proper will be 8 m. The whole width of the bridge is variable. The greatest distance between the axes of the main girders is 25 m., such a space being necessary to insure the stability of the structure under the action of violent gusts of wind. The roadways are of the ordinary width of 1·50 m. between the axes and the rails. The latter will be set in grooves to obviate accidents. The floor, made of ribbed sheet iron, is to cover the bridge throughout its length, so as to make every part accessible to the men appointed for the supervision of the bridge. Between and outside the roadways pavements are provided for the men to stand on, and thus keep out of the way of passing trains. Upon the flooring it will be possible to establish "refuges," stations for the guards, signal boxes, switches, etc. All these arrangements may be multiplied according to the requirements of the traffic, and scattered over any convenient points and spans. On the piers lighthouses may be erected, to indicate obstacles to be avoided.



THE PROPOSED RAILWAY BRIDGE BETWEEN ENGLAND AND FRANCE.

Boring Car Wheels.

In measuring the accuracy of a car wheel borer chuck, one is liable to believe the chuck to be correct when it is not so. The three jaws may be at equal distances from the center of the machine before the load is applied to the binding screws, but when a wheel is in position and the screws tightened up, the chucks may no longer be at equal distances. Therefore, it would seem that almost the only satisfactory way to determine the accuracy of the three-jawed chuck would be to place therein a wheel which had been turned to an exact circle and bored precisely true. The cutters then could be lowered into the axle fit, and by revolving the machine, measurements could be made as to its accuracy. Of late, much attention has been paid to grinding wheels, and it is not uncommon to see wheels on the tread of which considerable more material had been removed from one side than from the other; and while grinding wheels may not decrease their mileage when they are properly centered on the axle, yet if too much material is taken from one side, it is believed by several wheel makers that the mileage of the wheel may be considerably reduced. Grinding wheels will certainly make them true, but the knowledge of the possibilities of grinding should in nowise lead to a decrease in the care exercised in boring. The Chicago, Rock Island & Pacific has decided, after inspection of the mileage sheets of its car wheels, to do away with the process of grinding, having found that most wheels, when ground according to its system of grinding, are reduced in mileage about 20,000 miles. It is true that better chilled wheels are now being furnished railroad companies than ever before, but to obtain from them the mileage which their good qualities render possible, it is necessary that they be not only carefully centered, if they are not to be ground, but even more carefully centered if they are to be ground.—*Railroad Gazette.*

Natural Gas under Lake Erie.

A Chicago note, under date of October 21, says:

"A vein of natural gas was opened recently by two workmen engaged in sinking the shaft at the intermediate caisson of the new city water tunnel, about two miles out in the lake. The gas was ignited by the lamps in the workmen's hats. There were five at work in the shaft, and all of them were more or less seriously burned. The injured workmen were finally rescued and sent ashore on a tugboat."

THE MILITARY BICYCLE.

The art of war is now borrowing from applied science all the resources that are at the latter's disposal, and there is nothing up to velocipedism that is not contributing to the service of the army. For a few years past, the Germans have been using the velocipede for the rapid carriage of dispatches, and, on this side of the Vosges, the French have not neglected to put to profit the advantages of an analogous service, a corps of velocipedists having been organized in the army. The type of apparatus adopted is the bicycle, such as is seen in Fig. 1, which shows a French army velocipedist, during the period of a campaign, commissioned with the quick carriage of an urgent dispatch.

The English have gone beyond such a use of the velocipede for dispatch sending, and have endeavored to use it for the carriage of ammunition. A very curious experiment of this kind was very recently made at London with a multicycle apparatus constructed by a Mr. Singer.

This truly curious apparatus is shown in Fig. 2. It consists of a series of bicycles, six in number, each carrying two men, and hauling a small vehicle loaded with ammunition. The bicycles are arranged in a single file, instead of being two or four abreast, thus much facilitating the operation of the apparatus and diminishing the surface of resistance to the wind. The speed on a good road varies from 9½ to 15 miles per hour. The rubber tires are made in such a way as to secure them from being injured, even on roads that are somewhat stony.

The starting of the whole is under control of the man who sits in front. Recently the affair was run through one of the most frequented streets of London, and was found to turn easily in a much more circumscribed space than could have been done by an ordinary carriage, and to turn with great speed through the streets without any accident resulting. The body of men selected to maneuver this multicycle consists of experienced volunteers, who are capable, in addition, of going through all military evolutions.

Fig. 1.—FRENCH MILITARY VELOCIPEDISTS.

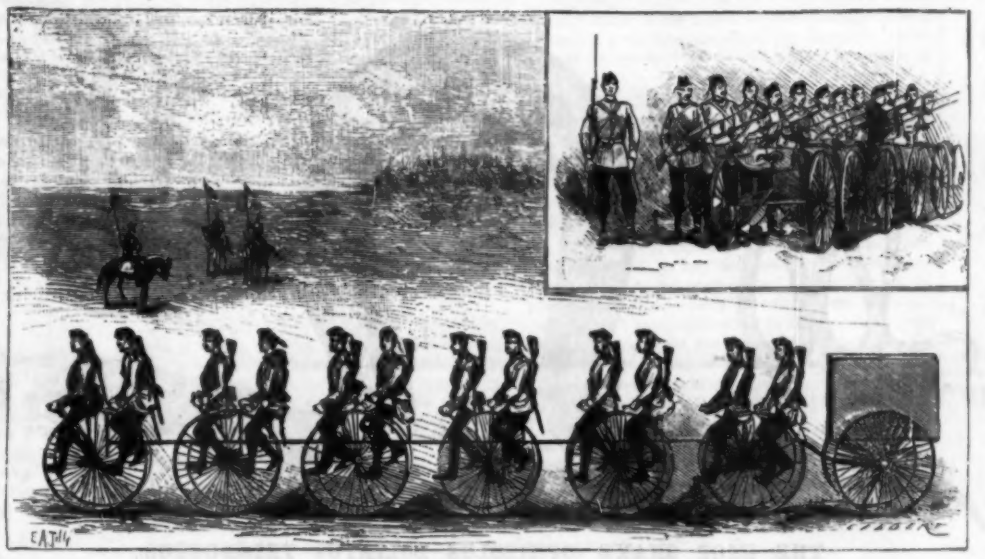


Fig. 2.—USE OF VELOCIPEDES IN THE ENGLISH ARMY.

Fig. 3 shows another phase in the use of the military bicycle as practiced in England, the illustration of which we borrow from the *Illustrated London News*.

A small body of cyclists, ten in number (two sections and a half-section), with officers and bugler, marching in usual order of half-sections—that is, by "twos"—are attacked by cavalry. At the word of command, "Halt!" "Prepare for cavalry!" "Form square!" each man dismounts; and the respective second half-section move up alongside their first half-section, so as to form a line of four men in front and rear, with a half-section of two men between them. Each man then grasps his machine at the point of balance, and turns it outward, so that they form a square, with the men inside, each machine overlapping by a few inches those next to it.

The rifles are lifted out of their clips as the machines are lowered to the ground, and are then placed on the ground for a moment, while the machines are grasped with both hands by the framework and placed upside down, so as to stand in a reversed position, resting on their handle bars and saddles.

Lastly, each man, as he lies or kneels down behind his machine, sets his wheels spinning round with a touch of his finger. Such a fence, apart from the *chevaux de frise* of bayonets behind it, forms an obstacle which few horses, if any, would face; and the men inside, in perfect security, can pick off the advancing horsemen with deadly effect.

The position, so far as mounted horsemen are concerned, is practically impregnable; while the infantry rifles, with which cyclists are armed, have great advantages, in accuracy and steadiness of aim, over the carbines of dismounted cavalry.

Japanese Lacquer.

From a paper on Japanese lacquer read lately by Mr. R. Hitchcock before the Chemical Society of Washington, D. C., we learn that Japanese lacquer is the product of a tree, the *Rhus vernicifera*, which grows throughout the main island of Japan. It attains a large size, the trunks sometimes measuring a meter in diameter. It is said the tree will live for forty years, but only comparatively young trees are valued for the production of lacquer. Having yielded for several years they are cut down, the lacquer extracted from the branches, and young trees take their places. Mr. Hitchcock urges it should receive more attention than has hitherto been devoted to it by manufacturers in America. "It gives a surface to wood," he says, "much harder than our best copal varnish, without brittleness. It takes a polish not to be excelled, which lasts for centuries, as we may see in the old treasures of Japan. It is proof against boiling water, alcohol, and, indeed, it seems to be insoluble in every agent known. It is the best possible application for laboratory tables. I have a set of photographer's developing trays that have been in use for more than a year, and I find them excellent and cheap. In Japan it is used for many household articles." Unfortunately, lacquer poisoning from the fresh material is a serious danger. According to Rein, the poison is a volatile acid, and Mr. Hitchcock suggests that it might be removed by a heat that would leave the lacquer uninjured.

The Divining Rod.

Professor E. Ray Lankester, having recently expressed some doubts upon the alleged powers of a boy "water finder," who has been in the employ of the Grinton Mining Company, in the North of England, the chairman of the company, Dr. M'Clure, has replied to them, denying emphatically that the boy, whose name is Rodwell, is an impostor. He says that the lad when tested never failed to find either water or mineral veins, the lodes having always been found exactly at the places indicated. The divining rod which he holds only moves in obedience to the muscular contractions of his hands, and a rod of any kind of wood or even of any material substance whatever can be used, provided it be a conductor of electricity. Rodwell usually walks with his hands tightly clasped before him, and as soon as he steps upon a mineral vein or water he is powerless to unclasp them until he moves away from the region of the lode or conduit. The lad is about 14 years of age. These statements by Dr. M'Clure have excited considerable comment in Yorkshire.

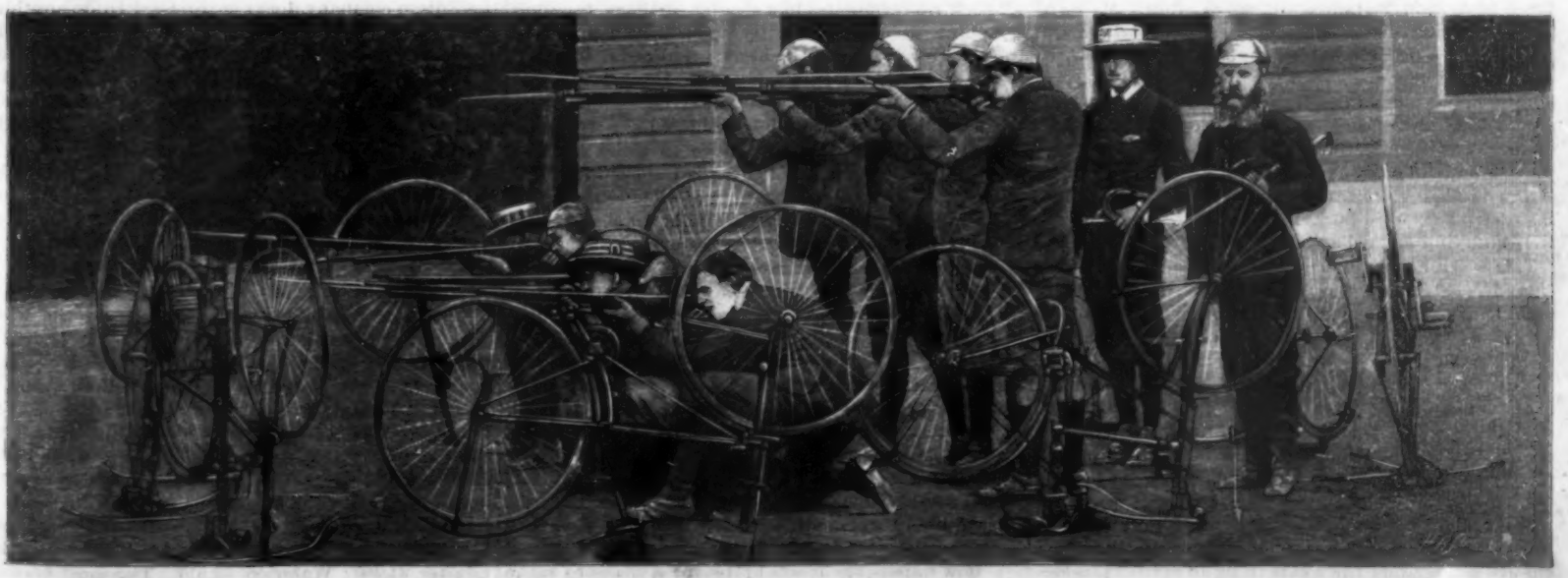


Fig. 3.—DRILL OF ENGLISH MILITARY BICYCLISTS.

THE HOOP SNAKE.

BY NICOLAS PIKE.

The serpent has been through all the ages an object of terror to man and beast. It has been and still is an object of worship by many nations—noticeably so by some of the native tribes of Hindostan. The death rate is fearfully increased in that country by bites from venomous snakes, and often whole families are bitten and the reptile goes free, because they fear to kill even an evil deity, as they look upon a cobra or other deadly reptile. Happily the missionaries and the heavy rewards offered by the British government for snake heads are breaking up some of this terrible creed. Even here a snake remains only a mysterious and repugnant reptile to the generality of mankind. Wisdom and subtlety, grace and ugliness, cunning and treachery, and a host of other qualities have been attributed to serpents, yet with two exceptions (the rattler and copperhead), like a good many people, they are not as bad as they seem.

It appears strange that at this late day the wildest superstitions are still extant with regard to reptile life, not only with the uncultured Indians, whose traditions are rich in serpent lore, but among most intelligent white men. There is one reason that may account partly for it. Nine out of ten people who meet a snake either kill it or run from it. In the latter case, fear not only lends wings to their feet, but to their imagination also. A harmless three-foot garter snake is magnified to six or seven feet at least, with hissing and venom thrown in. Now, if a little trouble were taken to watch some of the habits of the harmless snakes, they would soon lay aside their erroneous ideas.

There has been considerable written about the hoop or hoople snake, as the country people call it. It is firmly believed that it rolls over the plains of Long Island and elsewhere, and if you doubted it, they would think, if they did not say it, you were a booby. Students in the field (who ought to know better), farmers, and others, all men of intelligence and ordinary veracity, positively aver they have seen the snake roll often, and I do not doubt they believe it.

I will give one story to show how far credulity can go. A letter was received at the Smithsonian Institution, Washington, accompanied with an affidavit by a clergyman of the truthfulness of himself and a Mr. Laine, of Whittaker, N. C. The following is the gist of the story: "When in the suburbs of the town, Mr. Laine heard a noise behind him, and on looking round saw a hoop or horned snake three or four feet distant, rolling as he came on, with his tail in his mouth. When within striking distance, it disengaged the tail, struck at him, but missed its aim, when it stretched itself full length on the ground. A second attack was made, when Mr. Laine killed it, and he found the rear portion, one-third of the snake, capable of erection, firm and horn-like, all of which condition except 2½ inches of the tail disappeared after death!" Other stories speak of their striking trees with their horny tails and poisoning them!

While shooting at Pondquogue, I had a very intelligent man as a companion, who told me positively that he had often seen the milk snake roll, and all I could say to the contrary was of no avail. I could recite a dozen more such instances, did space allow. My own first acquaintance with this snake was over forty years ago, during a pedestrian tour round Long Island with a friend. While encamped on the Comac hills, we sauntered out one morning, gun in hand, pot hunting. As we descended a slope, a large snake started almost under my friend's feet, and he moved so rapidly forward, I had difficulty in checking his career with No. 8 shot. We had been warned to be very careful of these snakes, but we were both familiar with reptiles, and were studying and collecting them fearlessly.

This was a fine specimen of the milk snake, or *Ophibolus doliatus triangulus*, and as I was standing in an oblique direction from my friend and near the snake, I had an excellent opportunity of seeing its movements, rapid as they were. It darted from us in a succession of looping movements of the body, similar to those made by the measuring or geometrical worm in walking. This peculiar mode of progression is not confined to the milk snake, but the bull or pine snake (*Pityophis melanoleucus*) and the queen snake, or *O. getulus*, both have it. The apparent gyrating motion is caused by the lightning-like rapidity with which the reptile goes over the ground, that confuses the eye and renders the whole thing an optical illusion.

Three years ago I was hunting in a swamp, when I met a German who was in a great state of fright. He was cutting rushes for chairs, when he said he saw a great snake come rolling toward him, and he had cut it in two with his sickle. I went to the spot he indicated, and found a four-foot female milk snake. To show how easily such mistakes are made, I will state that this man had never heard of a rolling snake, yet he spoke of it as such quite confidently from what he had seen, and doubtless it did appear so to him.

I disturbed a milk snake once near Farmingdale, when it raised its head, elevated the body into what appeared to be a circle, but was in reality an elongated loop, and vanished down the slope. Had I not known its habits of progression, I should have believed in its rolling, so perfect was the delusion. Some time ago I had one of these creatures in confinement a whole winter. A favorite position was to raise one or two long loops and rest the head on one of them, the little bright eyes taking in everything that moved near it (see plate). Sometimes it raised only one loop, twisting its tail round the neck in most intricate folds and hiding its head, where it remained for days thus fast asleep.

Any one who has studied the anatomy of a serpent knows that it is impossible for it to gyrate in a perfect circle, still less could it roll with its tail in its mouth. It is difficult to understand the propelling power in these creatures without some knowledge of their organization. To look at a dead snake casually, it appears as if nature had somewhat neglected the Ophidians, and yet in truth she has provided a wonderful apparatus for giving them celerity in eluding danger, catching their live prey, climbing, swimming, or walking, hardly found in other animals.

I will give some idea of the mechanism employed, by quoting here and there from the old naturalist, P. M. Roget: "The solution of the enigma is partly solved by the structure of the skin, covered with numerous scales, and partly in the peculiar conformation of the ribs. The edges of the scales form rough projections, which are directed backward, so as to catch the surfaces of the bodies to which they are applied and to prevent any retrograde movement. Every scale is connected with a particular set of muscular fibers capable of raising or depressing it, so that in this way it is connected into a kind of toe, and thus the body rests on the ground by numerous fixed points of support."

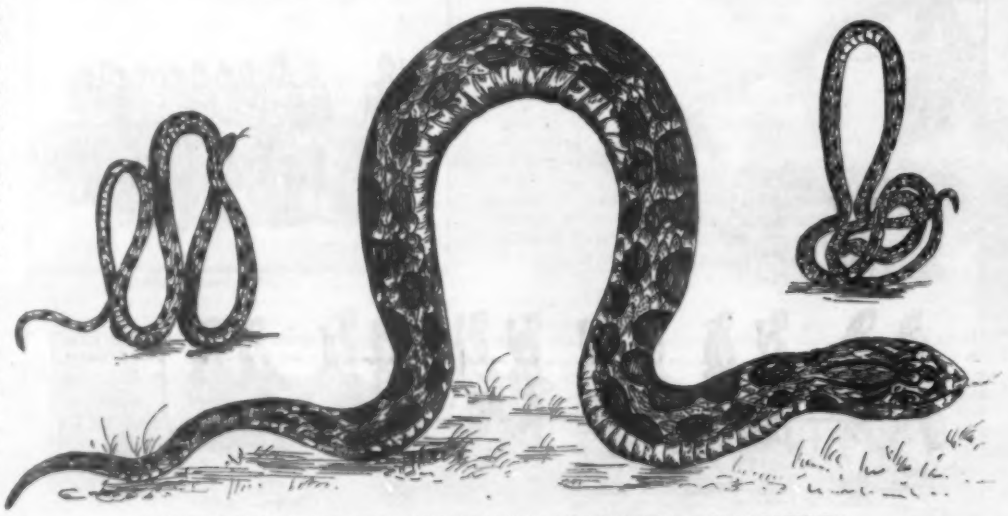
It would be out of place here to explain the whole form of the vertebra; suffice it to say that it admits of its assuming any degree and variety of curvature. Even this is not all—all the ribs play into concave protuberances of the vertebra. To quote further from the same author:

"Each rib terminates in a slender cartilage, tapering to a point, which rests for its whole length upon the upper surface of one of the broad *scuta* or broad scales on the under side of the body. These scuta are also moved by short muscles, and may be compared to hoofs; while the ribs may be considered as performing the office of legs. The ribs move in pairs, and the scutum under each pair being carried along with it in all its motions, and laying hold of the ground by its projecting ledge, becomes a fixed point for the advance of the body. The serpent advances by a creeping, vermicular motion—in fact, a succession of short steps; but its progress is accelerated by the curvatures into which it throws its body. Where expedition is needed, the body can be raised in one great arch, of which the extremities touch the ground. When in fear, or to escape danger, they coil themselves into a spiral by contracting the muscles of the body first on one side, then on the other, till it is propelled as if by the release and unwinding of a powerful spring with an impulse that raises it to some height from the ground and projects it to a considerable distance."

Now, if my unscientific readers will note the above rough outline of the organization of a serpent, they will see how impossible it would be for a snake to make itself into a circle, especially with its tail in its mouth. This would effectually stop progression, as all flexibility would be arrested, on which the creature depends for its marvelous speed. This superstition is on a par with the violent hissing of snakes and their poisonous tongues. The latter delicate organ is thrust out quivering when the snake is in fear, or actuated by curiosity (of which they have a large share) to touch any near object, and is constantly used on its food. I have often seen my snakes in confinement test the food offered by the tongue, and it was accepted or rejected by the result. As to hissing, very few snakes make any noise at all, and then it is more of a puffing, blowing, or whistling noise, and mostly noticeable during the breeding season.

I should like to touch on one point connected with snakes that should be impressed on every farmer in relation to the milk and other harmless snakes. It is a pity they are being so indiscriminately slaughtered. As the birds destroy insect life, snakes are the persevering hunters of rodents, beetles and their larvæ, etc. The farmers have already found out that by the destruction of insectivorous birds insect pests have increased, to the detriment of their crops. So it is that the same policy with regard to the harmless snakes is giving the rats and mice full sway in the harvest fields.

I will terminate with a story a farmer told me. He said there was an old snake on their farm that year by year made its appearance among the sheaves of corn and soon cleared them of vermin effectually. His father would not have the creature molested, and it came and went at pleasure. Farmers, kill all your rattlers and copperheads, but spare the harmless ones—it will pay you to do it.



THE HOOP SNAKE (OPHIBOLUS DOLIATUS TRIANGULUS).

The Brush Electric Company Sells Out.

The recent purchase, by the Thomson-Houston Company, of the property and franchises of the Brush Electric Company, of Cleveland, was a transaction altogether unexpected in electrical circles. Financially, it is the most important operation which has taken place in the electric lighting business since the era of combination and consolidation set in. The Brush company was the oldest one in the field. It has been managed from the outset with unflagging energy, and for the most part with uncommon commercial sagacity, and, as a natural consequence, has been eminently prosperous and successful. The Thomson-Houston company has certainly paid a long price for the property, but as the purchase brings under one control almost the whole of the arc lighting business of the United States, and at the same time disposes of a rival which was beginning to be troublesome in the direction of incandescent lighting and electric railroading, it is a question whether, after all, the bargain may not prove to have been a wise one.

The consolidation of electric companies by "heat and pressure," of which we have more than once spoken, has gone on with increasing rapidity during the past year. By far the greater number of the minor organizations have one by one fallen under the control either of the Thomson-Houston or the Westinghouse interests, until at the present moment the Edison company is about the only one of any prominence which has not succumbed to the inducements which one or the other of its stronger rivals have been able to offer. But as the Edison company does not pretend to do anything either in arc lighting or in incandescent lighting by alternate currents and converters, the bulk of the hard fighting, from this on, will necessarily be directly between the two powerful, well-equipped, and energetically managed organizations represented by Charles A. Coffin and George Westinghouse.

The absorption of the Brush company marks the beginning of what will doubtless prove to be the final and decisive struggle for supremacy in the electrical industries of this country.—*The Electrical Engineer.*

SOME statistics recently published by the city of Berlin show that London streets are on the whole the most crowded of any city in Europe. In 1878 it was ascertained that 43,014 people passed every 16 hours along the Leipziger Strasse in Berlin, and in 883, 36,000 people crossed the Jannowitz Bridge every 18 hours. The most crowded bridge in Berlin is the Oranin, over which 80,000 people pass every 18 hours. In 1884, 58,743 passed along the Muntz Strasse every 16 hours, and 47,506 along the Getraudten Strasse. In London it is estimated 110,525 pedestrians pass over London Bridge daily; over Blackfriars, 79,198; Westminster, 44,460; Waterloo, 32,815. The most crowded thoroughfare in Europe is the Pont Neuf, Paris.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM BOILER. — John M. Lachlan, New York City. This invention relates to marine and stationary boilers in which circulating pipes are employed in the fire box, and in the water space at the bottom of the boiler below the ash pit, the invention covering a novel construction and combination of parts whereby the circulation is made reliable and effective, and is placed under the easy and quick control of the engineer and fireman.

Railway Appliances.

CAR FLOOR.—Daniel H. Talbot, Sioux City, Iowa. This floor is made up of a series of parallel strips, united and held in position by bolts passed transversely through them, the strips being held a suitable distance apart by springs, the floor being elastic, and especially designed for freight and stock cars, being adapted for convenient application to any freight car.

RAIL TIE AND CLAMP. — Frederick Robert and Edward P. Eastwick, Jr., New York City. This tie is made of metal, and in connection therewith are employed two clamping blocks and two screw bolts, each bolt having screwed thereon an adjusting nut, whereby lateral movement of the rail sections may be readily obtained when desirable, the invention also providing means for removing the ties without affecting the rail sections.

CAR COUPLING.—Edward P. Eastwick, Jr., New York City. This coupler is of the vertical-plane hook type, and provides for a much greater bearing surface than usual of the revoluble knuckle, while the strain upon the drawhead caused by a buffing blow is reduced and taken up on the pin, which also answers for a locking pin.

CAR COUPLING. — Frederick Robert, New York City. This coupler is of the vertical-plane type, and the invention is designed to simplify the construction and do away with machine work, while providing large bearing surfaces for the knuckle, and novel means for taking up the buffing strain on the side of the drawhead, together with a locking device having a larger bearing surface than usual, and one in which the amount of lift of the pin is much reduced.

CAR COUPLING. — Charles H. Peard, Philadelphia, Pa. The drawhead of this coupling is formed with an aperture adapted to receive a coupling hook, while a standard to which a coupling hook is pivotally connected is mounted to slide in a second aperture in the drawhead, with means for operating the coupling hook, the device being designed for coupling freight cars of different heights without going between the cars.

Electrical.

DYNAMO-ELECTRIC MACHINE. — Heinrich Geisenhöner, Schenectady, N. Y. The frame of this machine has four loops in which are arranged the field magnet cores with their windings, the cores having polar extensions projecting on opposite sides of the frame, and two ring armatures revolving between the polar extensions on opposite sides of the machine, light or heavy currents of different intensities being obtained by changing the connections.

INCANDESCENT LAMP SOCKET. — Samuel Rodman, Jr., U. S. A. (at present stationed at Newport, R. I.) This invention provides a switch cylinder with a continuous spiral contact plate, there being spring tongues which bear against the cylinder and connections between the tongues and the light-producing agent, with other novel features, whereby the power or intensity of the light may be varied at will.

Mechanical.

SCREW MACHINE. — George Heyne, Offenbach-on-the-Main, Germany. This invention covers various combinations of devices for holding, feeding, turning, boring out, tapping, and cutting the rods or other pieces of metal from which the screws, nuts, and similar articles are to be made, the invention being an improvement on a former patented invention of the same inventor.

BOBBIN SPINDLE.—James Warrener, Fall River, Mass. This is a spindle or skewer with a bearing point partly of wood and partly of glass, having at its lower end a socket in which is a glass tip, the object being to lessen the amount of friction within the lower creel, while maintaining at all times a sufficient and uniform tension.

HEMMER FOR SEWING MACHINES. — Alice La Guayra Mayo, Great Falls, Montana Ter. This is an attachment for use with articles requiring a wider hem than the ordinary foil, the device affording means for turning a hem up to eight inches in width, and inserting a ribbon or tape within the hem, the hemmer also having a double gauge and being constructed in a simple and durable manner.

MEAL BOLT. — Conrad P. Steinmetz, Mitchell, Dakota Ter. This invention covers an improved shaking bolter in which a screen is secured to the shaking box of a feed mill, and receives its motion therefrom, this bolter being particularly adapted for bolting cornmeal, buckwheat, and other coarse grain.

Agricultural.

PLANTER. — Addison Leffel, Xenia, O. In this planter the wheels supporting the main frame have apertured fellies connected to hollow hubs, feed slides actuated by a cam plate being arranged in connection with the hub bores, while coverers are mounted to the rear of the wheels, the invention also covering other novel features of construction and arrangement of parts.

HARROW.—Joseph A. Beard, Liberty, Miss. This is a convertible harrow, designed to be simple and strong in construction, which can be readily changed to and used as a side harrow, a V-harrow, an A-harrow, and a T-harrow, the invention covering various novel features and combinations of parts.

COTTON PICKER. — William F. Snowdon, Brooklyn, N. Y. The frame of this picker has upper and lower lateral rotating rollers on which travels an endless belt, and having toothed aprons which dip into and between the plants to pick the cotton, there being a device for sweeping the cotton from the belt aprons into a chute.

SHEAF CARRIER. — Augustus Jewell, Dowagiac, Mich. This is an attachment for a self-binding harvester, and is so constructed that the bundles are dumped without hanging or catching in the arms of the carrier, the weight of the bundles assisting in dumping the load, while the dumping devices are effectively operated and locked by the foot of the driver.

Miscellaneous.

BALE TIE MACHINE.—Albert Henley, Lawrence, Kansas. This machine is specially designed to manufacture bale ties of wire for baling hay, straw, etc., and has a feeding mechanism and a cutter past which the wire extends, in combination with a longitudinally grooved rotary cylinder into which the wire is fed, with mechanism below the cylinder for successively operating covers to permit the wire to fall from the lowermost grooves.

AMALGAMATOR. — Nathan L. Raber, Corvallis, Oregon. This machine has a disintegrating feed wheel with upwardly projected ribs or flutes, the inner ends of which have inwardly facing cutting edges, a ring-like cover plate being secured to and revolving with the wheel, the chemicals for quickening the mercury being fed directly to the feed wheel, the motion of which effects an instantaneous and perfect distribution of the chemicals throughout the mercury space.

PIPE CARRIER.—Henry W. Petersen, Appleton, Wis. This carrier consists of an overhead track on which travels a truck supporting rods connected near their lower ends by a cross piece on which the pipe rests, being especially designed for conveniently holding pipe or other articles to be brazed or welded in a furnace fire and then running the pipe to an anvil or stake for welding, brazing, soldering, riveting, or putting the pipes together.

WATCH REGULATOR. — Frederick W. Schimmel, Wallace, Idaho Ter. The regulator has a curved screw and a nut with a circumferential groove near one end for receiving the end of a regulating lever, a star wheel being pivoted on the regulator, and there being other novel features, making a simple and effective device whereby the regulator may be positively moved a short distance, so that any owner of a watch may readily regulate it.

CHANGE DELIVERY APPARATUS. — David S. White, Huntley, Ill. A hopper is arranged under two pivotally mounted flanged plates or leaves, rods being connected to the leaves and a ring carried by the rods, the ring being arranged beneath the hopper, to provide for the quick and easy delivery of change and obviate the necessity of picking it up from the counter.

PENCIL SHARPENER. — Martin W. Walker, Sing Sing, N. Y. This sharpener has two sides inclined toward each other on which cutting edges are radially formed, an apertured bottom plate connecting the lower ends of the sides, and points being secured to their upper ends, to fasten the device to the frame of a slate.

PENCIL SHARPENING GAUGE.—George P. W. Holman, United States Navy, Torpedo Station, Newport, R. I. This is a gauge and point protector, to facilitate the true sharpening of pencils or crayons without soiling the hands or breaking the point, and consists of a tubular case cut away diagonally at one side to provide ganging faces for a cutter, an axially rotatable pencil clamp being fitted into the case.

BOOK REST.—John P. Findley, Blanchard, Pa. This is a rest designed for attachment to a chair or seat, for holding a book firmly, and by which the book may be readily adjusted to any desired position, the device being of simple and inexpensive construction.

ARTIFICIAL STONE. — Carolene M. Egbert, Westfield, Pa. This is a compound to be moulded in a molten state, and used for tombstones, vases, statues, etc., becoming very hard and durable, being made of thallium, glass, calamine, alum, white lead, white prepared chalk, etc., combined in specified proportions and in a manner described.

COMPOSITION FOR MOULDINGS.—Paul E. Gonon, New York City. Two patents have been issued to this inventor for a composition of matter which, when dried, is an imitation of wood or metal, or bronze, and whose density can readily be made equal to that of the different kinds of wood and metals, while the substance may be moulded or worked into ornamental articles or carved as wood is carved, and can be easily made fire proof.

MITER BOX.—William S. Herrington, San Francisco, Cal. This is a box readily adjustable to admit any sized stick, moulding, or board to be operated on, the box being one which can be quickly taken apart for convenience in carrying or packing, the invention covering various novel parts and details designed to provide a simple and durable construction.

BAKING DISH. — Mary H. Holcomb, Fargo, Dakota Ter. This dish is arranged to have attached to it an ornamental rim or cover provided with drapery, so that such dishes may be placed upon a handsomely arranged and well furnished table, and will present an attractive appearance.

PLATE OR DISH WASHER.—Thomas A. Pudan, Sacramento, Cal. A brush is mounted to be revolved in a casing by means of a horizontal shaft, the brush being held by a spring in contact with a plate held in the holder, the casing holding water prepared for the cleaning and having a separate compartment for rinsing.

FOLDING BOX. — Charles Schwartz, Brooklyn, N. Y. This is an improved paper box, adapted to be folded flat for shipment or packing, and is made with folding walls adapted to be drawn up by a tape and locked to hold the box firmly in upright position, the end walls having flaps with locking tongues to enter slots in the outer end flaps, and the cover of the box being a part of the blank.

ICE TONGS.—John Sosenhamer, Hamilton, Pa. In these tongs the lower ends of the handles and the upper ends of the arms are pivoted together, the arms being then pivoted to the handles at points inside their individual pivotal points, whereby a slight movement of the handles gives a wide movement of the arms, and increases the rapidity and efficiency of their use.

HAND TRUCK.—Joseph P. Menard and Edward T. Weyman, Missoula, Montana Ter. This truck has a forwardly projecting arm, at the outer end of which is a horizontal clamp, a rod for operating the clamp, and a lever pivoted to the rod and truck, the device being designed especially for use in moving plow bottoms from place to place.

FIRE ESCAPE. — Lewis E. Morrison, Brooklyn, N. Y. This invention provides a fire escape designed to automatically prevent the too free run of the lowering rope, avoid severe shocks, and insure smooth and uninterrupted descent, while it can be made at but little expense, and is adapted to safely and smoothly lower any weight from any height.

MATTRESS. — Henry C. Farrell, New York City. The casing of this mattress has top and bottom aprons at the sides and ends, so laced that the top and bottom of the casing may be drawn taut, and affording provision whereby a circulation of air may be obtained through the mattress at all times.

BARREL COVER. — Charles F. Heins, Charleston, S. C. This cover consists of two parts pivoted for movement face to face, one part having a hoop adapted to fit a barrel top, with a spring normally closing the cover and a latch normally holding the cover open, the cover being one which may be simply laid on top of the barrel or be secured thereto by screws or nails.

SLED.—John D. Thomas, Petoskey, Mich. This is a sled adapted for propulsion by means of oar-like attachments, the oar-like levers each having on its outer end a foot furnished with spikes or prongs adapted to enable the operator to obtain a strong hold upon the ice or road bed over which the sleigh is propelled.

SHAFT SUPPORT.—John Vander Noot and Gerard W. Ryder, Gravesend, N. Y. Standards carrying hooks are arranged for connection with the forward axle, chains being connected to the shafts and arranged for connection with the hooks, whereby the shafts will be upheld and the draught animal relieved of the burden of their weight, and the shafts may also be held in elevated position when the vehicle is stored.

BRICK PALLET. — Robert J. Stuart, New Hamburg, N. Y. This is an improved pallet for supporting unburned bricks while being dried, and has vertical projections on its top against which the legs or supports of the superposed pallets rest, by means of which the several pallets may be arranged vertically on a car, and will be held from displacement by the swaying of the car.

TRAP. — Michael B. Nicholson, New York City. This trap has the usual U-shaped body, between the vertical members of which is a nearly closed chamber, having communication through small openings at the bottom and one upper edge with the main pipe, whereby, when the regular discharge is siphoned out, a discharge will be effected from the closed chamber sufficient to seal the trap.

STAVE BASKET. — John W. Alleger, Brooklyn, N. Y. The base of this basket is formed of a hoop or band of angle iron, the staves being attached to the vertical member of the hoop, while the bottom is forced down inside the staves upon the horizontal member of the hoop, the bottom being thus firmly supported and held, and making a basket adapted to withstand hard usage.

SKATE.—Thomas H. McQuown, Biggsville, Ill. The runner of this skate is made in two parts, the front part being pivoted on a bracket fastened to the front end of the rear runner and the front end of the sole plate section, the skate providing for readily passing over uneven ice, for making short curves, etc.

CANDLESTICK. — John P. Nessle, Newark, N. J. This candlestick has a weighted sliding frame with an opening for the candle, the frame descending as the candle is consumed, while the melted part of the candle is turned inward toward the wick, so that it will not run down the sides, and every particle of the candle is consumed.

VEGETABLE TOOL.—August Hirschel, Hackensack, N. J. This tool has a coring scoop portion, having a knife, and a flattened, spout-like portion having a transverse slot, and constructed to form a cutter on its back, making an implement especially adapted for peeling or scraping vegetables, with means for slicing and grating uses as well.

TRASH BURNING STOVE. — George C. Werner, Beatrice, Neb. This stove has an outer sheet metal case, within the walls of which, leaving a slight space, is held a perforated sheathing, there being upper and lower draught-controlling slides, and other novel features, providing for the ready removal of the stove body to dump the ashes and to refill the body with trash.

WASHING MACHINE.—William T. Venable, Christiansburg, Ky. This machine has a reciprocating shaft having stirring and agitating arms, and a double-acting spring buffer connected with, and acting on the shaft, within a closed tank or receptacle, the mechanism being designed to operate quickly and easily without strain on the parts.

STRAP ATTACHMENT.—Walter Nelson, Wheeling, West Va. This is a strip of sheet metal with clamping lugs on its under side and guides on top adapted to receive the strap, a strip of flexible material being held on the under side by the lugs, making an improved strap for carrying shawls, satchels, etc., the attachment serving to conveniently hold the strap in place on the shoulder.

TRUNK HINGE. — Henry T. Helbing, Highland, N. Y. This invention covers a novel construction of the joint portion of the hinge and the hinge pin, whereby the lid or cover when thrown open, or nearly open, is held supported in such position by the hinge, and all other straps, cords, or jointed braces, are dispensed with.

TRIPOD.—John F. Godillot, New York City. The legs of this tripod may be readily detached from the table, and the sections disconnected and shoved together and fastened, to be carried or packed in small space, the table also taking little room, the tripod being light and more particularly designed for photographers and surveyors.

VEHICLE BRAKE. — John M. Hardin, Gest, Ky. This invention provides a brake adapted to be applied to the wheels and removed by the team, the brakes being applied when the team backs, as in going down hill, and removed when the team starts forward, means being provided whereby the brake may be held out of contact with the wheels when the vehicle is to be backed.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1530) G. T. R. asks for a recipe for a harmless compound which will stimulate the growth of hair on the face. A. We have little confidence in any supposed promoters of the growth of the hair. Try the following: Croton oil 12 drops, sweet oil of almonds ½ oz. troy. Mix and rub on skin gently twice a day. If too irritating, double the amount of sweet almond oil. It is poisonous.

(1531) F. A.—The specimen is chalcedony, of no value.

(1532) F. B. asks for (1) a receipt for making carton pierre ornaments for picture frames. A. The following is a formula for such a composition:

Glue previously dissolved in water	13 parts.
Pulverized litharge	4 "
White lead	9 "
Plaster of Paris	1 "
Very fine sawdust	10 "

Oil the moulds in which it is cast to prevent adhesion. 2. Can you refer me to any receipt books that tell how to make carton pierre ornaments? A. You will find other formulas in "Workshop Receipts," 1st series, pp. 123 and 301. We can supply this work by mail for $2.

(1533) W. C. E. writes: I have some moose horns which have become stained by lying on the ground. Please tell me through the Notes and Queries column of the SCIENTIFIC AMERICAN how I can clean and bleach them? A. Use binoxide of hydrogen mixed with a little ammonia. The first is sold in the drug stores as hair bleach. Apply cautiously with a rag, so as not to bleach too powerfully.

(1534) W. D. S. writes: In this market has just appeared what is termed anti-rusting tinware, made in the ordinary manner, with the addition of a cross of sheet zinc soldered to the inner side of the bottom of each piece. Now one question is, if this zinc, or whatever it may be, prevents rust, what is the action set up that brings about the result? Is it at the expense of the zinc by means of very slow oxidation? The other question is, are these articles perfectly safe for culinary purposes? A. The metal is zinc. It prevents oxidation of the iron by galvanic action, becoming oxidized itself. Such articles are dangerous, and not to be recommended for culinary purposes.

(1535) No Name asks whether electricity is a fluid or not. Two say it is, and three say it is not a fluid. A. Electricity is called a fluid for convenience. It is supposed to be wave motion.

(1536) A. K. writes: 1. Here (Columbia, S. C.) we often see drops of water like rainfall under the trees when the sun is shining and the sky is perfectly clear. What is the cause? A. The roots absorb more moisture than can be evaporated from the leaves. Hence the tree breaks out into visible perspiration, just as a human being does. 2. Please give formula for expansion of compressed air when heated. A. For each degree Fahrenheit air expands 1-491 part of its volume at 32° F. 3. For information on bookbinding we refer you to Workshop Receipts, 4th series, which we can send by mail for $2.

(1537) W. C. G. asks: 1. How can I make a good preparation, liquid or paste, for labeling tin or glass, which will not corrode the tin and will be cheap? A. Use a fresh solution of gum tragacanth. 2. Want to make composition, with glue or resin as basis. What will harden and make waterproof, also be cheap? A. Use resin melted up with brickdust or sawdust to proper consistency. Also see answer to query 1532, 3. What is expense of filing a caveat? A. We file caveats for twenty-five dollars.

(1538) Dr. G. V. R. asks: In a wooden container separated into two equal parts by a thin metallic partition, each side to be nearly filled with water for the purpose of decomposition, by electrolysis—in such an apparatus, would the gases be given off at the immersed electrodes the same as if no partition existed between them? If not, why not? A. No; because the molecules of water must interchange atoms with each other, which is impossible with an impermeable screen between the electrodes. The water in either cell might decompose, giving off hydrogen from the screen and oxygen from the electrode, and *vice versa*. 2. Would a porous non-metallic partition work in such a case? A. Yes.

(1539) B. G. asks for a receipt for ebonizing wood. A. Boil 40 parts gall nuts, 4 parts rasped logwood, 5 parts each of sulphate of iron and verdigris with water, strain through linen, and apply warm. Follow by three coats of a solution 10 parts iron filings, in 75 parts vinegar.

(1540) B. G. K.—Habitual divers in salt water often have inflammation of the eyes. The exposure such diving necessitates is not beneficial. The only proper way to keep a gun barrel in good order is to wash it out with boiling hot water, dry with linen swabs and oil with vaseline or cylinder oil, every time that it is used. It should never be laid aside unattended to for a day or two after firing.

(1541) A. L. K.—See SCIENTIFIC AMERICAN SUPPLEMENT, No. 316, for the art of japanning. See Techno-Chemical Receipts, which we mail for $2, on How to Copper and Tin Iron.

(1542) H. C. B.—Zinc expands up to the melting point. A bar of hammered zinc 6 inches long will expand one one-hundredth of an inch in raising the temperature 100° Fah.

(1543) A. T.—There is no practical nor profitable way of removing copper and zinc from plumber's solder. Care and good methods of working should keep it free enough for purposes of the trade.

(1544) G. W. W. asks: What preparation is used to make quicksilver adhere to glass and metals? A. On mirrors an amalgam with tin is used. Tin foil is placed on a flat surface, and mercury is poured over it. The perfectly clean glass is slid over it with its front edge under the surface, and when in place is put under pressure for some time. It is then placed on edge and allowed to drain for a day or more. For glass and metals no surface adhesion of pure mercury as a rule can be produced. Such metals as it amalgamates with, rapidly absorb it into their substance.

(1545) J. S. asks: 1. Which magnet has the most power—artificial or natural? A. The artificial is far the most powerful. 2. If a magnet ever loses its attractive power, when left to itself. A. Yes; unless provided with a keeper, a piece of iron in contact with both poles. Bar magnets are best arranged in pairs side by side a little distance apart, with keepers across the center. Their poles must be in opposite directions.

(1546) W. B. R. asks: In what number is described how to make a flash light for photographic use? What material is flash cotton made of? I have tried ordinary cotton saturated with alcohol, but it would not burn the magnesium powder. A. See SCIENTIFIC AMERICAN, Oct. 15, 1887, page 241. Flash cotton is gun cotton, used in making collodion. See page 116 of February 25, 1889, issue SCIENTIFIC AMERICAN. 2. Have you a good formula for hydroquinone developer? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 621.

(1547) J. L. D. asks: 1. How can a vessel be filled with gas, without the use of water? A. By displacing the air. If the gas is lighter than air, the vessel should be inverted and the gas allowed to stream into it. If heavier, the reverse position should be chosen. In either case, the gas should, by means of a tube, be led as near to the bottom of the vessel as possible. There will always be a considerable loss of gas, and without a strong current it will not be at all free from air. 2. Is sugar of lead, or acetate of lead, or any preparation of lead, used in the manufacture of common writing inks, or of the printing inks of various colors used nowadays? A. Oxide of lead, or litharge, may be used to some extent as a drier in such compounds. 3. Could some form of lead be used in them without detriment to the desirable qualities of such inks? A. It is not injurious.

(1548) G. S. asks whether bisulphide of carbon is dangerous to use, and what its properties are. A. It is volatile, combustible, asphyxiating, and poisonous. When it burns, it produces sulphurous acid gas, that is irrespirable and poisonous. 2. I would like to know whether turpentine mixed with charcoal is dangerous to use, and what its properties are? A. It would have some tendency toward spontaneous combustion, and would be highly inflammable in any case.

(1549) W. R. C. asks: Is a combined lead and iron pipe more injurious to drinking water than one entirely lead? A. Not as regards healthfulness, but any iron in contact with the water would rust and discolor it.

(1550) W. S. asks: Is a ray of light a body or not? A. A ray of light is theoretically a series of ether waves. The ether is a hypothetical body whose existence has never been proved. You may say in any case that a ray of light is not a body.

(1551) C. E. J. writes: May I ask you to publish in your next weekly issue of your valuable paper as many of the most useful things for inventors to work on as you can think of? A. Their name is legion. The skill of an inventor is as much exercised in finding a want as in supplying it. Look around you, and see where improvements are needed, cultivate observation, and you will find plenty to work on.

(1552) E. J. R. says: Please let me know how to make a good concrete pavement. A. Portland or Rosendale cement one part, clean, sharp sand three parts. Make a thick mortar and spread three inches thick.

(1553) Florida asks (1) method of preserving figs, as they are beginning to be sold in Northern markets. The pulp, which is the only part used, comes in oblong shape about date size and is sugar incrusted. A. Fig paste is thus made: 10 pounds figs are cut up finely and boiled to a pulp with a little over 1 gallon of water. This is strained through a sieve and 30 pounds of sugar are added. It is evaporated in a water bath until stiff. It may be poured into moulds of any desired shape. Carefully cooked corn starch may be added to the above before the last evaporation. After removal from the moulds, which must open or come apart, roll in sugar. 2. Best way to prevent mildew on books. A. Keep dry, and air occasionally. There is no other preventive. 3. If cinchona can be grown here, and if so, some information as to its cultivation. A. It is very doubtful. Address the Secretary of Agriculture, Washington, D. C. 4. Do you consider Burn's Fonic Shorthand System (which you recently recommended to a correspondent) better than Pitman's or Graham's, and how does it differ from each? A. We cannot decide as to relative merits of shorthand systems. 5. It is stated that Arabs of the desert live to the age of 200 years. About how near the truth is this? Are there any statistics by which you can inform me which is the longest-lived race, and the percentage of centenarians? A. We do not believe it. Such reports are far from reliable. 6. What is Greek fire? A. Probably a bituminous composition. Its composition is not known. 7. Best way to clear out roaches. A. Use powdered borax. 8. How to tell oleomargarine, etc., from butter. A. Analysis by a competent chemist. Butter experts claim to be able to tell by taste, appearance, etc. 9. How to detect adulterations of milk? A. Analysis by a chemist is the only certain way. We import and supply foreign books by mail.

(1554) A. B. C. writes: 1. Will you please tell me where I can get a very easy book on plain drawing, as I would like to learn, and have got no book. I want an easy one, regardless of cost. A. Plan and Map Drawing, by Andre, price $3.75. 2. Also, will a ball shot out of a gun strike an object harder at a distance of three feet or at a distance of ten, or does it decrease in speed the instant it leaves the powder? A. It will gain in velocity until it leaves the mouth of the gun, and then will at once begin to lose velocity. 3. In a recent issue I see a question, Can animals see in the dark? The answer was, no. Now, if you ever worked in a mine, you would be led to believe they can. Take mule a mule under the ground, in a mine, and he will come out or travel the roads all right. How is it? A. No animal can see in the dark. The mule may, by his highly developed sense of smell and touch, together with memory, do what you describe. What seems absolute darkness to us may not be really so. 4. Can a cubic foot be made square on all corners? A. Theoretically, it can; practically, only with the greatest difficulty.

(1555) J. H. S. asks (1) for method of making cyanide of copper solution for plating iron and other metals.

A. Water	1000	parts.
Acetate of copper (crystallized)	20	"
Carbonate of soda	20	"
Bisulphite of soda	20	"
Cyanide of potassium (pure)	20	"

First mix the acetate of copper with just enough water to make a paste, then add the carbonate of soda and 200 parts of water; after stirring add the bisulphite of soda and 200 parts of water, and finally the rest of the water and the cyanide of potassium. If the liquid appears blue add enough cyanide to decolorize it. 2. Also instead of Russia iron for field magnet in simple electric motor, would a wrought iron one answer as well? If so, how thick should the iron be? A. Yes; make of the same dimensions. 3. Would No. 19 iron wire do to wind armature core in same? A. Yes.

(1556) J. M. B. writes: In mixing 160 grains tannin, 1 ounce sulphate iron, and 1 pint water, a blue-black fluid is evolved, which is perfectly free from particles for about six hours, after which time a thin coat forms on top of the solution. What is this thin coat, and how can I prevent its formation? A. The thin coating is a precipitate of tannate of iron. It is present from the first, but in so finely divided a form as not to be visible as a solid. To prevent its deposition, mix a little mucilage with the water.

(1557) E. G. S. writes: I load vessels monthly at New York with ice for the West Indies, and my consignees out there claim that no other but lake ice will suit or stand the climate, while icemen of good authority here say to the contrary, and that river ice is better than lake ice. How is it? A. The water of still, deep ponds or lakes is purer or more free from suspended mineral or vegetable matter than the flowing water of rivers. The ice from such sources will therefore be more clear and solid. The clear, still water of lakes has also less air than moving streams, this likewise contributing to the density of lake ice. The difference between water of Lake George for instance and that of the Hudson River can be seen at a glance. Objects that can readily be seen at from 20 to 30 feet below the surface in Lake George may be only seen at from 3 to 4 feet in the clearest water on the Hudson below Albany. The clearest and densest ice keeps the longest.

(1558) A. T. O. asks: 1. What is the lowest degree of cold that has been produced artificially, and by what means was it accomplished? A. By evaporation of solid nitrogen a temperature of —226° C. has been obtained. An interesting note on the subject is given in the SCIENTIFIC AMERICAN of February 27, 1886, page 137. 2. Is it generally believed by scientists that if a substance, say gold, were cooled to 273 C., or —459 2-5 Fah., its molecules would come in actual contact, and that there could be no further change in temperature in that direction? A. We do not know what would happen, except that the molecules would be in contact, and there could be no further diminution of volume. 3. Why would not the addition of matter to the earth, as by falling aerolites, so disturb the adjustment of gravity to centrifugal force as to change the orbit of the earth, causing it to be projected into space or drawn into the sun? A. If sufficient in amount, very grave changes might be thus produced. No perceptible ones can be traced to such a source.

(1559) E. E. asks (1) if gasoline has been successfully used in gas engines as a motive power. What would be the amount consumed in gallons per hour per indicated horse power? A. About ½ gallon. 2. Could the gas evolved from gasoline be ignited by an electric spark in a cylinder? A. Yes. 3. In what proportion should the gas be used, mixed with air and introduced with a pump? A. About 1 of gas to 20 of air. 4. Would such a motor be dangerous? A. Not necessarily. The principal danger is in the storage, etc., of the gasoline. It might affect insurance also. 5. Please suggest a plan for generating the gas before introducing it into the cylinder? A. Draw the air through a vessel containing gasoline over its surface; wicks may be used to increase the surface.

(1560) E. G. C. asks how to make elastic gelatine moulds for electroplating. A. Soak gelatine for twenty-four hours in cold water, drain off the water, and heat in an ordinary glue pot. After pouring over object allow to stand twelve hours before removing. This is only available for rapid plating. It may be protected to a certain extent by pouring over it a 10 per cent solution of bichromate of potash and exposing it to the sun, or it may be varnished, a solution of India rubber in bisulphide of carbon or benzole being the best varnish to use. Try mixing with skim milk as below.

(1561) F. M. W. asked in query 1452 about waterproof glue. W. R. D. B. writes us that glue mixed with skim milk will resist water after drying.

(1562) J. L. writes: I have tried a mixture of coal tar, glue, plaster of Paris and pitch to cover glassware with to make it appear like the bark of a tree after painting it the proper colors. It works in some way well enough, only the composition does not grow hard enough, so that it sooner or later will come off again. Can you suggest me another composition for this purpose or some means how to harden the mixture described above? A. We would suggest that you use strong alum water to mix your plaster of Paris with. A little glycerine (10 per cent of the dry glue) will make glue less brittle. With these two suggestions you will probably be able to make a stronger composition.

(1563) C. A. writes: How many feet of radiating surface to each 100 cubic feet of air space does one need in hot water heating? What temperature is the water usually kept at? Is it above 212° Fah., heating in frame buildings, and is hot water heating practical in a small way? A. For direct radiation with the coils in room, use 1 square foot of heating surface to 80 cubic feet of space in ordinary rooms with hot water circulation. If for indirect heating by coils in air chambers with registers in rooms, the proportion may be 1 square foot to 50 cubic feet of space. With a tank pressure upon the pipes from the upper story a full temperature of 212° or 214° may be obtained in the lower coils. Generally with open tank at top of building, any temperature below 212° may be had to correspond with the outside temperature. The hot water system is most desirable for small houses.

(1564) J. H. K.—There is nothing equal to friction, with the leather slightly damp, for giving a high polish on the edge of fresh cut sole leather. There is no varnish made or used for the purpose. The friction should be sufficient to just stop short of burning the leather. For recipes for cologne and a great variety of fine perfumes, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 472 and 486. Gum benzoin is sometimes used instead of vanilla, as well as with it.

(1565) M. G. asks: 1. Is there a wax used in taking impressions of type for stereotyping which will stand the heat of melted type metal without melting, and if so, what is it? A. We know of no such material. *Papier maché* is now generally used. 2. I desire to preserve specimens of fruits of various kinds for exhibition. Alcohol destroys the natural color of the fruit and in a few months becomes discolored so as to prevent a fair view of the fruit. Is there any other liquid which will be preferable? A. You will get some useful hints from the article on this subject in our issue of November 2, 1889, page 273.

(1566) J. A. M.—The "weather plant" described by Norvack is *Abrus precatorius*, of the order Leguminosæ. The plant was originally a native of India, but is now found in the West Indies, South America, and other warm countries. The scarlet seeds with a black hilum are much used for necklaces, and are employed in India as a standard of weight. The weight of the famous Koh-i-noor diamond was ascertained in this way. The roots are sweet and taste like licorice, whence the name licorice bush. Other names are red bean and love pea.

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